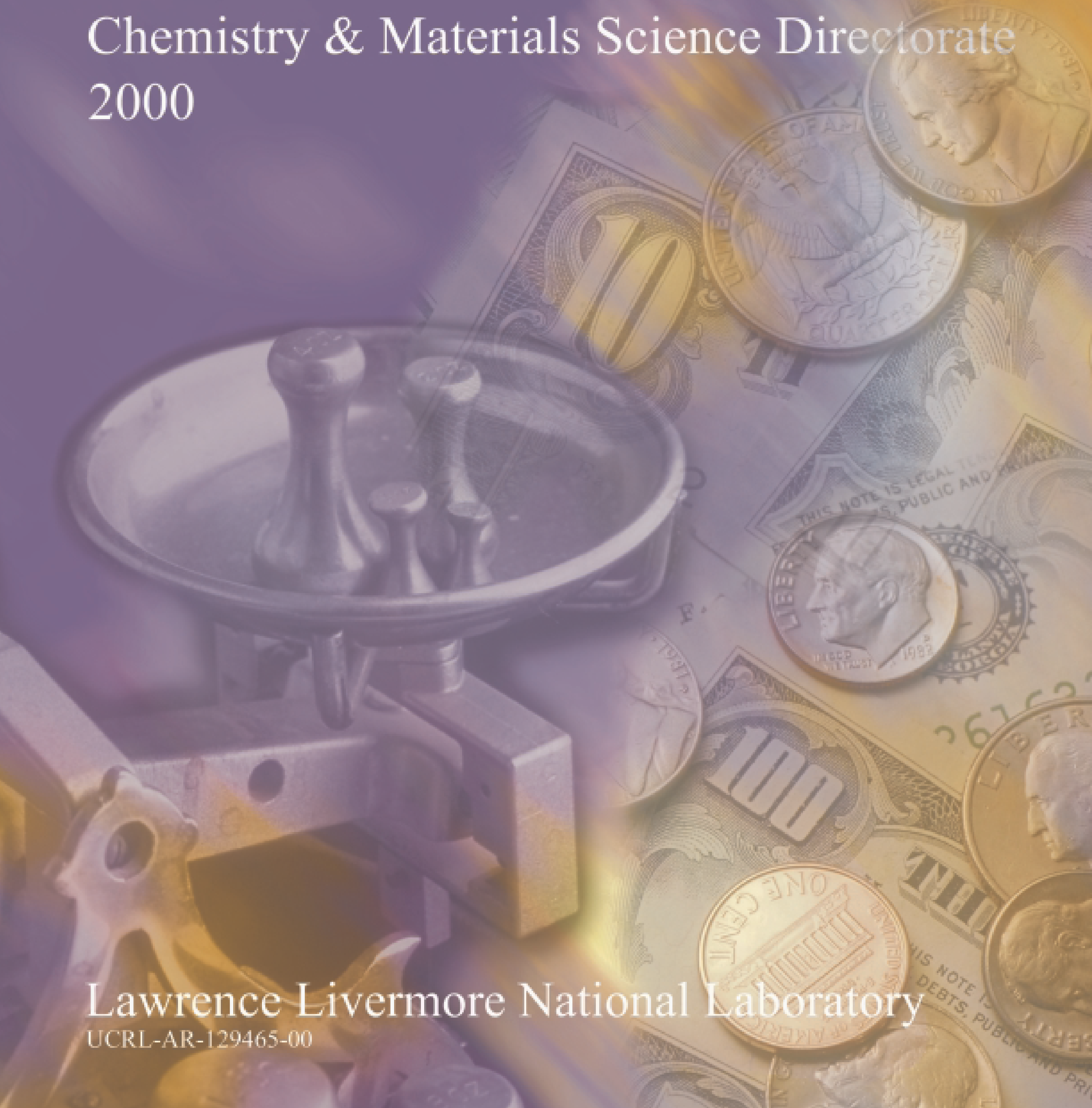
FACTS & FIGURES

Chemistry & Materials Science Directorate 2000



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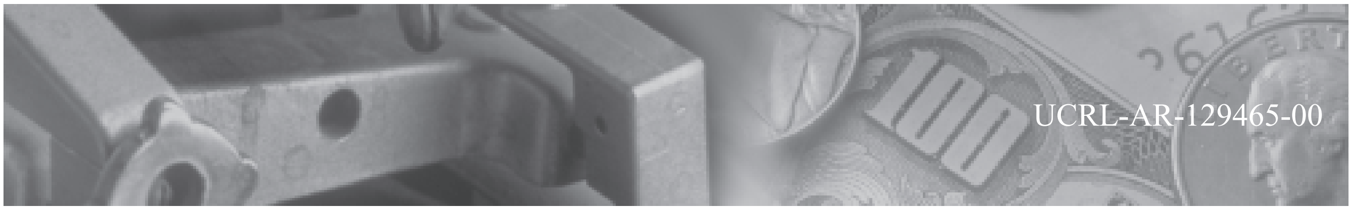

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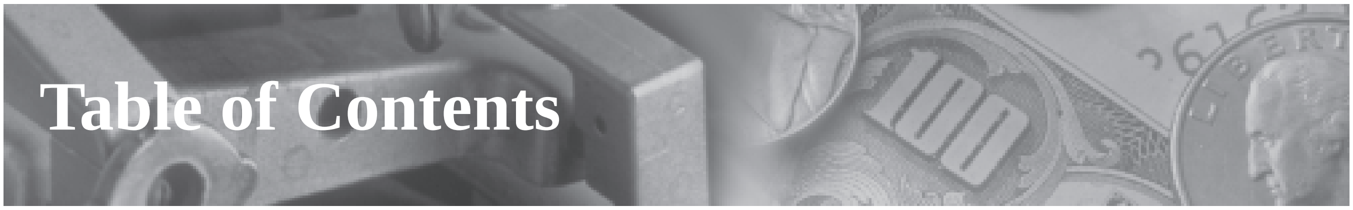
Chemistry & Materials Science Directorate 2000

Publication Date: January 2000



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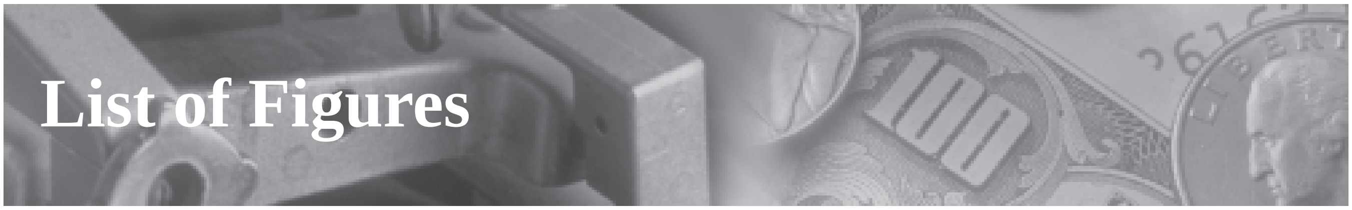

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1. Introduction

Facts & Figures contains a broad overview of budgetary, personnel and other administrative information about Lawrence Livermore National Laboratory (LLNL) and specifically the Chemistry and Materials Science (CMS) Directorate. For a more detailed, comprehensive overview of the Laboratory's mission, and expenditures, refer to the LLNL Institutional Plan @ http://www.llnl.gov/llnl/ip/

2. The Laboratory

Mission

LLNL is a premier applied-science national security laboratory. Its primary mission is to ensure that the nation's nuclear weapons remain safe, secure, and reliable and to prevent the spread and use of nuclear weapons worldwide.

This mission enables Lab Programs in advanced defense technologies, energy, environment, biosciences, and basic science to apply their unique capabilities and to enhance the competencies needed for the national security mission.

The Laboratory serves as a resource to U.S. government and a partner with industry and academia.

Vision and Goals

The Laboratory's goal is to apply the best science and technology to enhance the security and well being of the nation and to make the world a safer place.

Financial and FTE Highlights

As of August 31, 1999, operating and capital expenses totaled $1,198.6M. This included $941.2M for the Laboratory operating budgets and $257.3M for capital projects. FY00 operating and capital budgets are projected to be $1,321.7M. The staffing level as of August 31, 1999 was 7,254 full time equivalents (FTEs), including full-time, part-time, and indeterminate time employees. As of October 5, 1999, planned FTEs are 7,043. (See Table 1 for the correct breakdown of financial and FTE information by major program.) FTEs, a term used to describe a full-time employee who, during the course of a year, takes an average amount of vacation, sick leave, and other leave in addition to normal holiday leave. Therefore, FTE totals are not equivalent to number of employees.

Figures 1 and 2 show Operating costs and FTEs from FY90 to FY99 (through August 31, 1999).

Staffing and Demographics

As of July 31, 1999, the LLNL workforce (by head count) is 8,988. This workforce is comprised of 74% career, 11% non-career, 2% postdoctoral, 4% student, 2% retiree and 7% supplemental labor (see Table 2). The staff profile (excluding summer hires and temporary program participants) showed 40% scientific staff, 24% administrative and clerical, and 36% technical and crafts personnel. About 46% of the scientists and engineers have a Ph.D. (see Table 3). Engineers/Patent Engineers make up the largest scientific job group (35%). The scientific staff by Discipline is shown along with Postdoctoral Labor (see Table 4).

Operations

Figure 3 shows the matrix system of management used to operate the Laboratory. The major function "Program Directorates" are shown horizontally, and the "Program Support Directorates" are shown vertically to illustrate the matrix operation and cross-affiliation. Each Program organization is headed by an Associate Director (AD). The Service Organizations report through the Deputy Directors and include services such as Plant Operations, Controller, Legal Council, etc.   Most of the support Directorate staff are assigned to work in one of the Programs, i.e., matrixed to a Program Directorate. Programmatic work assignments for an individual can change from time to time, but the administrative home tends to remain relatively constant.

Organization

No standardized organizational structure exists within the Program and Support Directorates. Each Directorate is organized by its AD to more efficiently meet the needs and mission of the organization (see Figure 4).

***Table 1.** Laboratory Costs ($M) and FTEs by Major Program.*

Major Program	FY99 Actual 8/31/99		FY00 Planned 10/5/99	
	$ (M)	FTEs	$ (M)	FTEs
Operating				
DP01—Weapons Core Stockpile Stewardship	326.3	977	426.6	1,043
DP04—Weapons Stockpile Management	36.5	122	35.2	104
Technology Transfer/CRADA's & Education	4.6	18	3.2	13
DP02—Inertial Confinement Fusion (ICF)	82.3	241	108.5	354
National Ignition Facility (NIF)	14.6	9	5.8	8
GA—Fissile Material Disposition	23.6	57	25.0	57
Non-Proliferation & Intelligence	72.8	215	85.8	223
Environmental Restoration & Waste Mgmt	45.0	202	50.1	194
Other Defense	13.2	41	13.2	37
Magnetic Fusion	11.0	43	11.1	4
NER Supercomputer Center	0.0	—	0.0	—
Biomedical & Environmental	33.6	131	46.3	177
Office of Basic Energy Science (OBES)	12.6	27	12.3	31
Energy Research	12.9	45	17.3	51
WFDOE	67.3	240	76.5	246
Non-DOE	184.9	641	154.0	449
Total Sponsor Funded Operating	**941.2**	**3,018**	**1,070.8**	**3,026**
Capital				
Major Items of Equipment	1.0	6	0.0	0
DOE GPP	8.0	0	5.9	0
DOE Line Item Construction	33.4	62	45.1	46
National Ignition Facility Capital	214.8	377	199.9	50
Total Sponsor Funded Capital	**257.3**	**445**	**250.9**	**96**
Total Sponsor Funded Operating & Capital	**1,198.6**	**3,463**	**1,321.7**	**3,122**
Distributed				
Laboratory Directed R&D (LDRD)	—	282	—	253
Plant Engineering Jobs	—	899	—	941
Organization Facility (OFC)	—	248	—	244
Organization Personnel (OPC)	—	554	—	565
Program Management (PMC)	—	350	—	371
General & Administrative (G&A)	—	1,458	—	1,548
Total Distributed		**3,791**		**3,921**
Total Operating, Capital & Distributed	**1,198.6**	**7,254**	**1,321.7**	**7,043**

Minor variances may be due to rounding.

***Table 2.** LLNL Workforce.*

Workforce Category	Heads	Staff%
Career	**6,657**	**74%**
Full-Time	6,333	70%
Part-Time	240	3%
Leave of Absence	84	1%
Non-Career	**980**	**11%**
Term (Full-Time)	243	3%
Term (Part-Time)	5	0%
Indeterminate	87	1%
Flex Term	643	7%
Leave of Absence	2	0%
Total Career and Non-Career	**7,637**	**85%**
Other Labor	**684**	**8%**
Postdoctorals	138	2%
Retirees	185	2%
Students	361	4%
Other Labor non-LLNL	**667**	**7%**
Supplemental Labor	667	
Total Other Labor	**1,351**	**15%**
Total Laboratory Heads	**8,988**	**100%**

Dated: July 31, 1999.

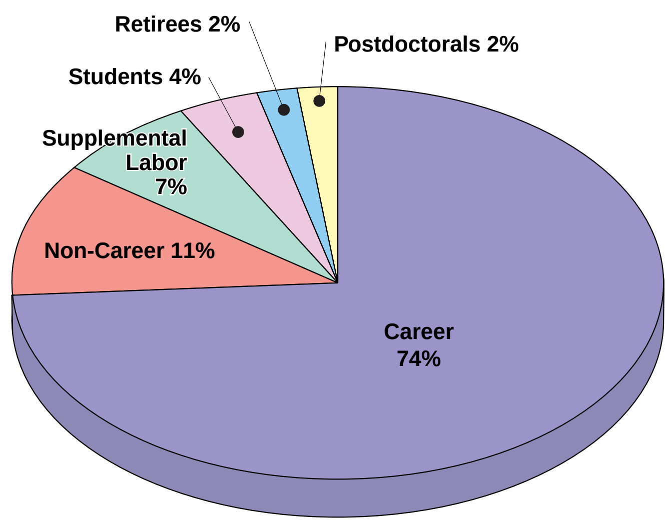


Table 3. *LLNL Staff Profile by Job Title and Degree Composition.*

Job Title	PhD	MS	BS	AA	No Degree	Total	Staff%
Scientists & Engineers	**1,238**	**789**	**602**	**6**	**37**	**2,672**	**40%**
Physicist—(270)	658	88	28	0	2	776	12%
Chemist—(242)	127	32	38	0	0	197	3%
Engineer/Patent Eng.— (168, 249)	280	406	236	4	17	943	14%
Mathematician/Comp Sci.—(256, 285)	90	204	251	2	17	564	8%
Biological Scientist—(221, 225, 235, 277)	23	14	17	0	0	54	1%
Environmental Scientist—(230)	18	32	28	0	0	78	1%
Metallurgist—(265)	29	7	2	0	1	39	1%
Medical Doctor—(263)	6	1	0	0	0	7	0%
Political Scientist—(295)	7	5	2	0	0	14	0%
Administrative & Clerical	**31**	**174**	**317**	**138**	**957**	**1,617**	**24%**
Management—(196, 197)	16	53	32	2	14	117	2%
Professional—(163–165, 169, 170)	6	25	30	1	13	75	1%
Administrative—(100–162)	9	95	215	72	353	744	11%
Clerical/Genl Services—(400–462)	0	1	40	63	577	681	10%
Technical & Crafts	**1**	**28**	**339**	**688**	**1,419**	**2,475**	**36%**
Security/Fire Dept.—(051, 055, 650–656)	0	1	25	38	157	221	3%
Technical—(302–339, 347–391, 502–588)	1	27	301	579	873	1,781	26%
Fac/Trades—(700, 701, 704, 722–799, 801, 805–990)	0	0	13	71	389	473	7%
Total Laboratory Heads	**1,270**	**991**	**1,258**	**832**	**2,413**	**6,764**	**100%**
Degree Composition %	**19%**	**15%**	**18%**	**12%**	**36%**	**100%**	

NOTE: Excludes summer hires & temporary program participants.
Dated: July 31, 1999.

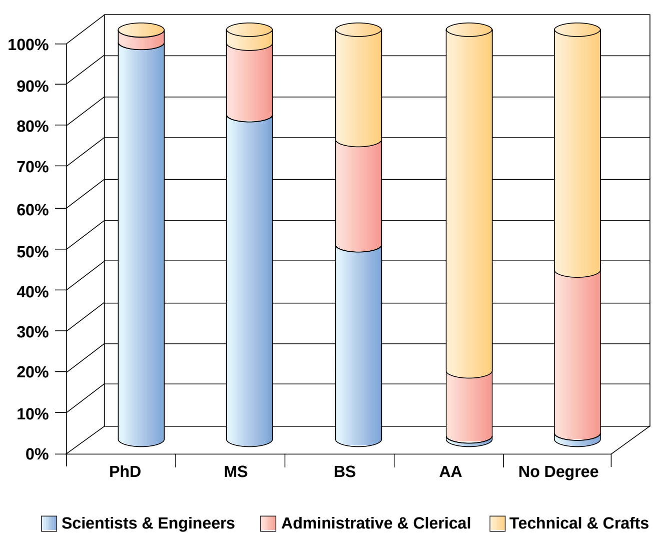
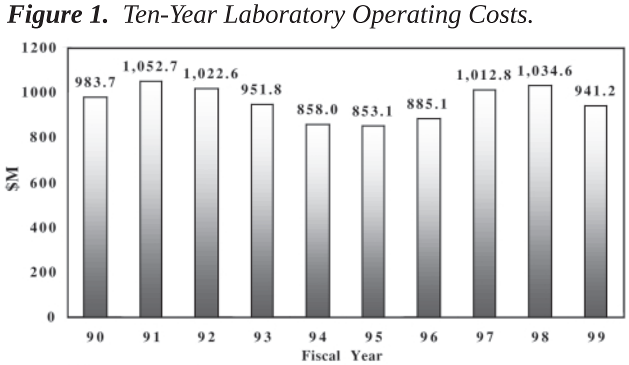
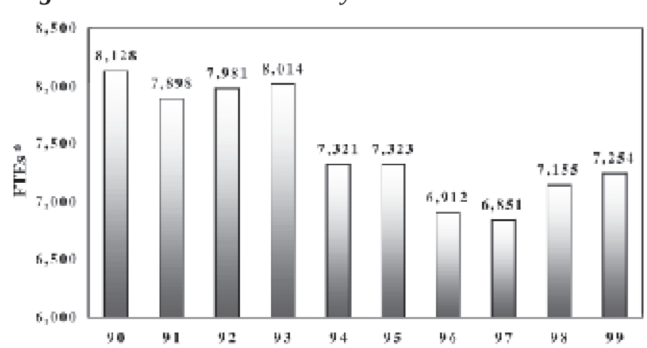


Figure 1. *Ten-Year Laboratory Operating Costs.*



FY99 actuals reported as of August 31, 1999

Figure 2. *Ten-Year Laboratory FTEs.*



*Does not include Postdoctorals or Retirees
FY99 actuals reported as of August 31, 1999

Table 4. *LLNL Scientists & Engineers by Discipline and Postdoctorals.*

Job Title	Heads	Staff%
Scientists & Engineers	2,672	95%
Physicist—(270)	776	28%
Chemist—(242)	197	7%
Engineer/Patent Eng.—(168, 249)	943	34%
Mathematician/Computer Scientist—(256, 285)	564	20%
Biological Scientist—(221, 225, 235, 277)	54	2%
Environmental Scientist—(230)	78	3%
Metallurgist—(265)	39	1%
Medical Doctor—(263)	7	0%
Political Scientist—(295)	14	0%
Postdoctorals	138	5%
Total Laboratory Heads	**2,810**	**100%**

Dated: July 31, 1999.

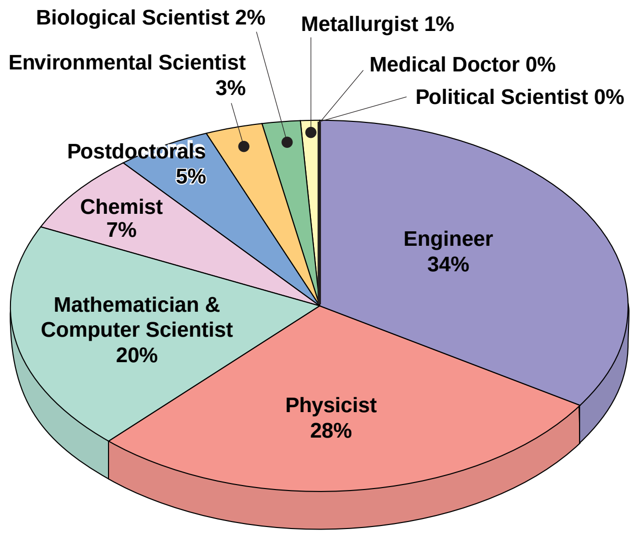


Figure 3. *LLNL Organizational Matrix.*

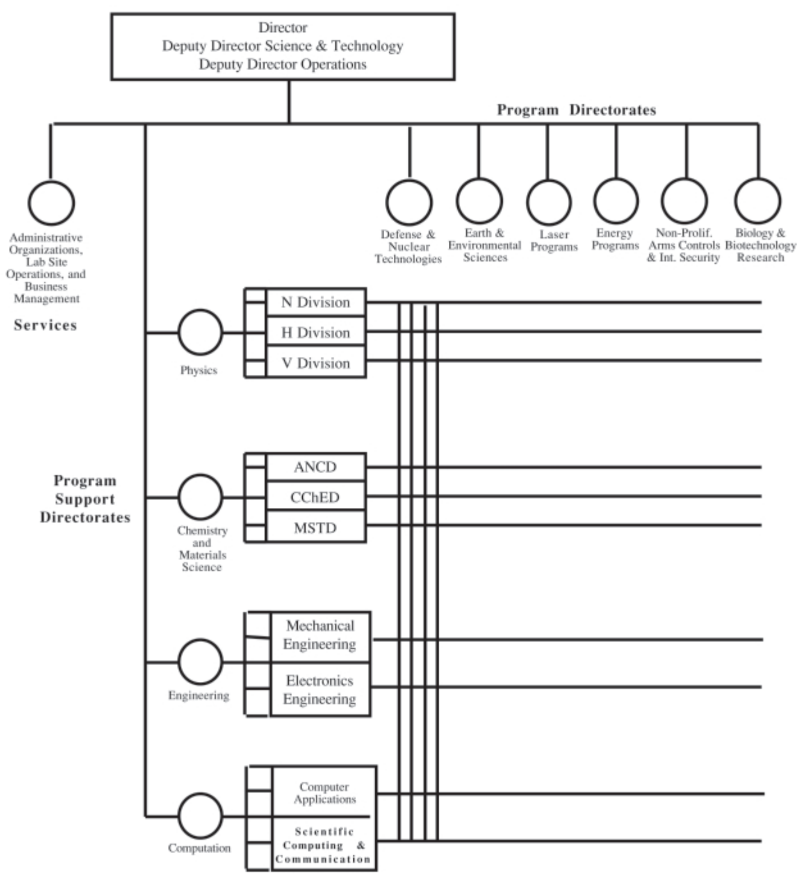
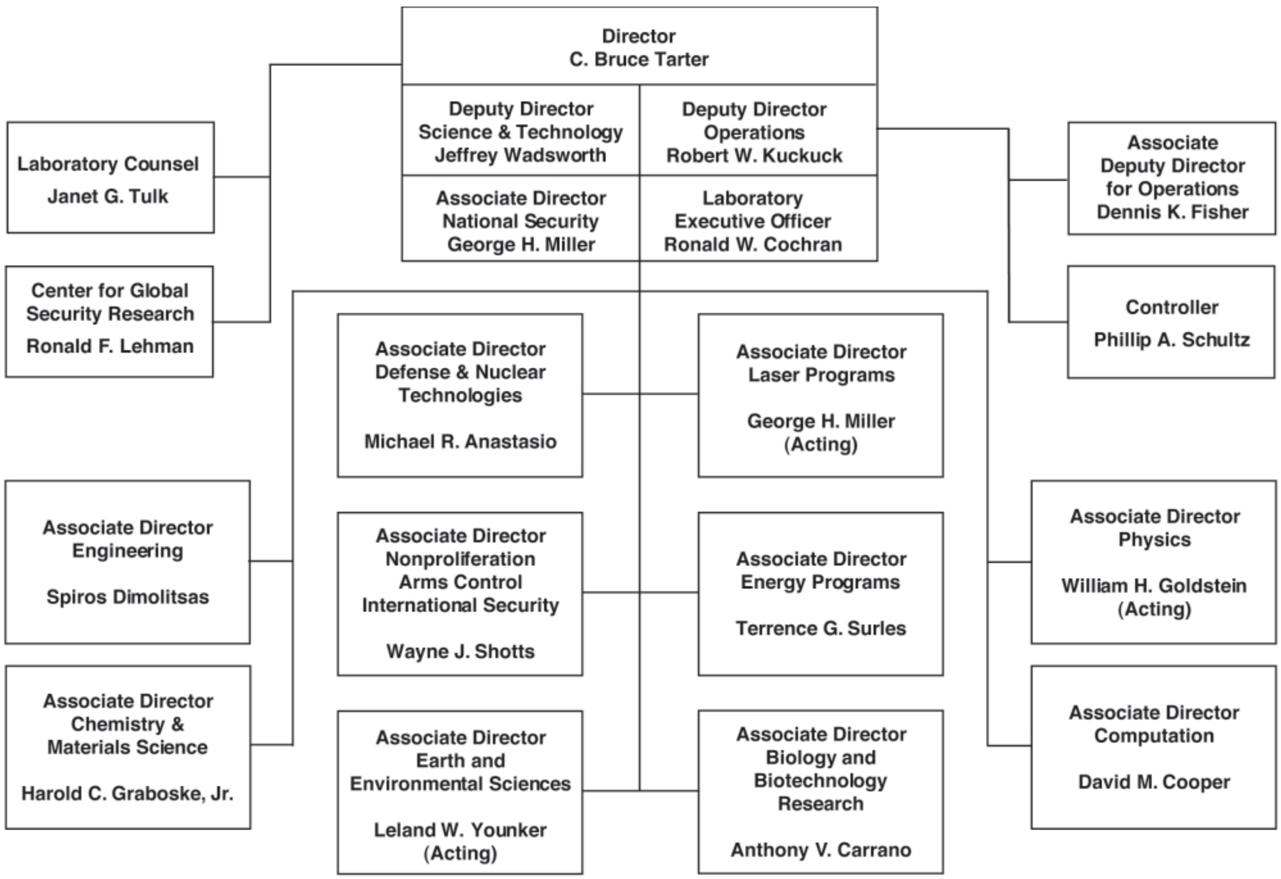


Figure 4. *LLNL Organizational Chart.*



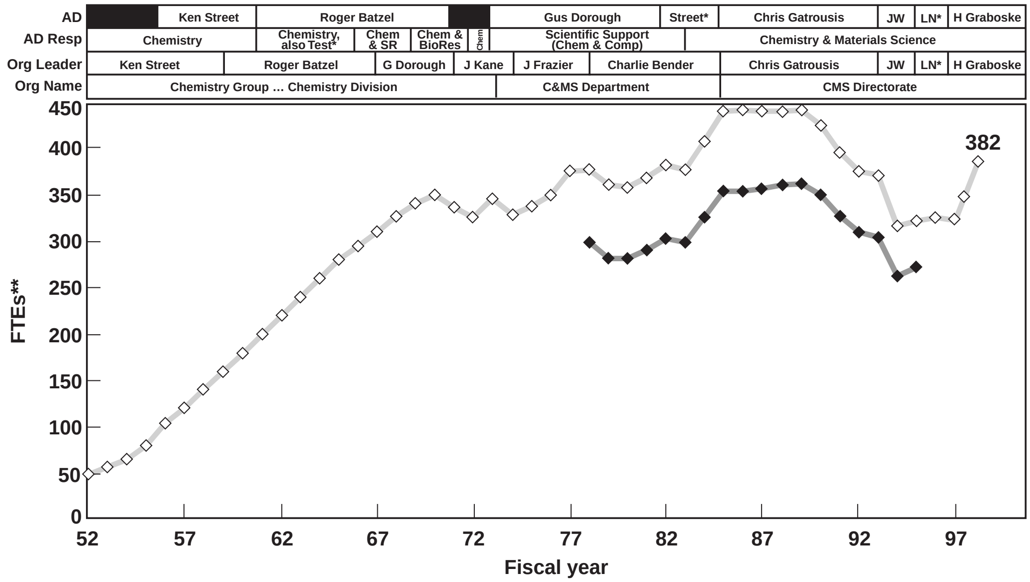
3. Chemistry and Materials Science

History

Since the Laboratory's inception in 1952, Chemistry as a discipline has been identified as a separate organization. It has been called Chemistry Group, Chemistry Division, Chemistry Department, Chemistry and Materials Science Department, and since 1985, the Chemistry and Materials Science Directorate. Table 5 and Figure 5 outline the major changes in the Directorate from 1952 to the present.

Table 5. *Chronological History of CMS Directorate Management (1952–present).*

Date	Chronology
1952	Chemistry Group reports to E. O. Lawrence through Herb York. 50 of the 308 FTEs at LLNL. Ken Street is the Department Head. Roger Batzel is the Assistant Department Head.
1956	Ken Street becomes DL, Chemistry, and also AD, UCRL-L (February 22, 1956 Administrative memo: Clarification of organizational structure at UCRL-L).
1959	Ken Street goes to UCB (returns in 1974 as AD for E&RP). Chemistry Division, under Roger Batzel, reports to Edward Teller.
1961	Roger Batzel named AD for Chemistry and Acting AD for Test (remains Department Head).
1966	Roger Batzel becomes AD for Chemistry and Space Reactor Program.
1967	Gus Dorough becomes Department Head of Chemistry.
1969	Roger Batzel becomes AD for Chemistry and Biomedical Research.
1971	Roger Batzel becomes LLNL Director. Jim Kane becomes Department Head of Chemistry.
1973	Gus Dorough becomes AD for Scientific Support (which included Chemistry and Computations). The Chemistry Department becomes the Chemistry and Materials Science Department.
1974	Jim Kane goes to Washington (he took a position as Technical Assistant to the General Manager, AEC in 1974; he later became head of Energy Research. In 1985, Kane was appointed Special Assistant for Laboratory Affairs, Office of the President, UC under Senior V.P. Bill Frazer). Jack Frazer becomes Chemistry Department Head.
1977	Radiochemistry Division moves to Nuclear Test Directorate and is renamed Nuclear Chemistry Division (under Chris Gatrousis).
1978	Charles Bender becomes Chemistry Department Head.
1982	Ken Street becomes Acting AD for Chemistry and Computations.
1983	Bob Borchers named AD for Computations. Computations no longer reports to AD for Chemistry.
1985	Chris Gatrousis becomes AD for CMS.
1994	Jeff Wadsworth becomes AD for CMS. Nuclear Chemistry Division is added to CMS Directorate.
1996	Larry Newkirk becomes Acting AD for CMS.
1997	Hal Graboske becomes AD for CMS.



AD names Jeffrey Wadsworth (JW) and Lawrence Newkirk (LN)

* Acting

**FTEs do not include Postdoctorals and Retirees

◆—◆ From '78 to '95 the Analytical & Nuclear Chemistry Division (formerly CMS Isotope Sciences Division & Test Program Nuclear Chemistry Division) was transferred out

Figure 5. *CMS History.*

Mission

- To be the primary provider of materials science and chemistry vital to the success of Laboratory Programs.
- To lead the development and enhancement of expertise in materials science and chemistry for the Laboratory.

Year 2004 Vision

- CMS is the cornerstone of LLNL's nationally recognized excellence for material and chemical sciences.
- The Lab and its Programs view CMS as a highly valued, relevant partner and as the preeminent partner of effective materials and chemistry solutions required to assure success of their missions.
- CMS has outstanding technical and operations/administrative staff with state-of-the-art research and facilities for long-term institutional excellence.

Operations

The scientific and technical discipline activities of the Directorate can be divided into three broad categories:

- CMS staff are assigned to work directly in a Program—a matrix assignment typically involving short deadlines and critical time schedules.
- The development, management and delivery of analytical, characterization, measurement, synthesis, processing and computing capabilities and scientific services to Programs.
- Longer-term research and development activities in technologies important to Laboratory Programs, determining the focus and direction of technology-based work on programmatic needs.

Integrated Safety Management (ISM)

Integrated Safety Management (ISM) is a formalized safety system intended to demonstratively integrate safety into all aspects of work planning and the execution of all activities.

In FY99, Institutional ISM requirements were the result of LLNL's careful examination of its approach to safety. Laboratory employees participated in Institution-wide activities associated with the communication of ISM and required training programs.

Additionally, Hal Graboske established a Scientific Safety Team (SST) in CMS with a charter to design, communicate, and implement ISM with the emphasis on "worker safety". The team included scientific/technical personnel from each division and members of Division and Directorate Management. Together, they hosted meetings to describe the team's charter, objectives, strategy, and implementation schedule for the Directorate.

Organization and Administration

The organization has evolved and expanded its technical breadth and depth over time focusing on a broad span of materials sciences. The organization now houses the institutional focus on a broad base of chemical, analytical, and the materials sciences experimental and computational expertise and capabilities (see Table 6).

Figure 6 shows the current CMS organization. The AD office includes Infrastructure activities that span the Directorate spectrum (e.g., functions such as administration, resource management, materials program leaders, facility operations, personnel, assurances, and computer support). The scientific and technical activities of the Directorate are conducted in the divisions.

Table 6. *CMS Focus and Activity Profile.**

Focus	Activity
Divisions	• Analytical and Nuclear Chemistry Division (ANCD) [Glenn T. Seaborg Institute for Transactinium Science (ITS)] • Chemistry and Chemical Engineering Division (CChED) • Materials Science and Technology Division (MSTD)
Programs	• Stockpile Stewardship Management Program (SSMP) • Laser Programs • Nonproliferation, Arms Control, and International Security (NAI) • Energy and Environment Materials Program Office • Department of Defense (DoD) Technologies
Capabilities	• Materials, Computation, Analysis, and Processing (MCAP)
Institutional	• Space Action Team (SAT)
Mentoring	• Postdoctoral Program

*Directorate organizational charts are at the end of this section.

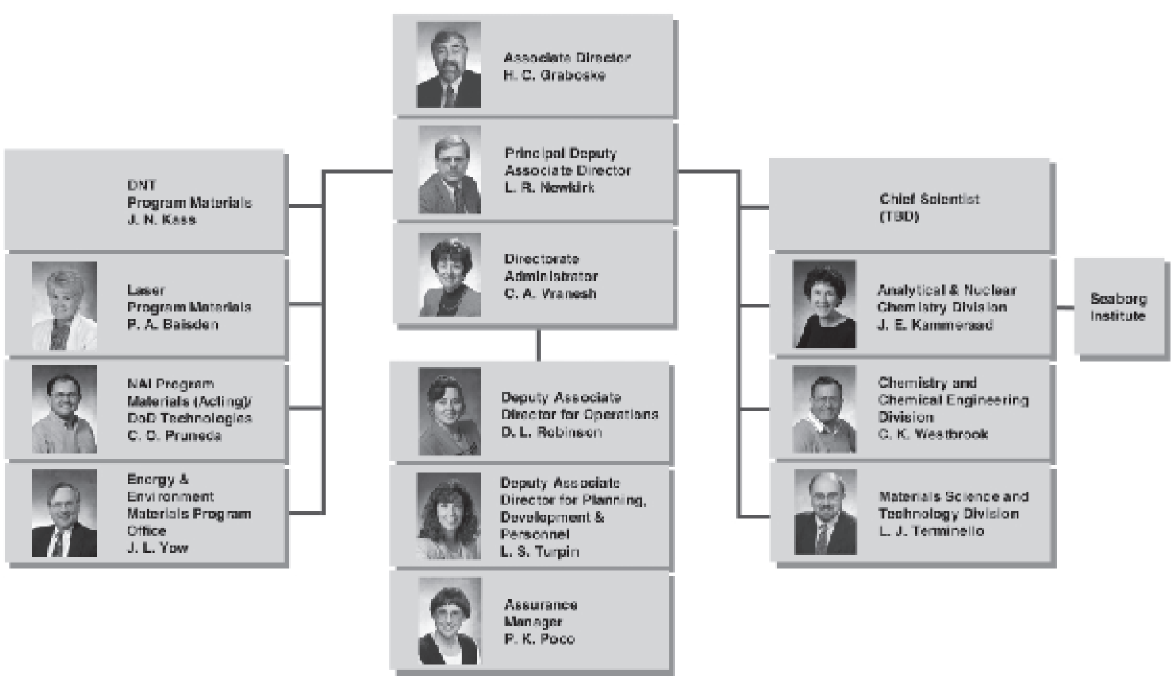


Figure 6. *Organizational Structure of the CMS Directorate.*

Division Focus

Analytical & Nuclear Chemistry Division— Judy Kammeraad, Division Leader

The underlying scientific expertise necessary for the Analytical & Nuclear Chemistry Division (ANCD) to solve programmatic problems is identified and nurtured within seven Scientific Capability areas. Generally, each capability represents a multidisciplinary mix of scientific specialties. The mix is dynamic and continues to change and evolve to serve a varying landscape of national security concerns addressed by the Division. The current ANCD Scientific Capabilities are:

- Nuclear Radiation Detection and Spectroscopy,
- Radiochemistry,
- Inorganic Analytical Chemistry,
- Nuclear Properties,
- Isotope Geochemistry,
- Inorganic Mass Spectrometry, and
- Organic Analytical Chemistry.

Each of these capabilities has been assigned a Leader who is responsible for developing and promoting the collective disciplines that comprise the capability.

While the ANCD Scientific Capabilities are routinely exercised by programs to serve direct programmatic needs, the advance of existing capabilities—and/or the addition of new capabilities—is accomplished through various forms of competitive institutional investment. LDRD is one such investment; FY00 research activities that have been proposed to advance selected scientific elements within ANCD are:

- Mapping of Enhanced Nuclear Stability in the Heaviest Elements—Radiochemistry;
- Real-Time Detection and Identification of Biological Aerosols with Mass Spectrometry—Organic Analytical Chemistry;
- Colloidal Transport of Actinides in the Vadose Zone—Isotope Geochemistry;
- Background Reduction and Full Volume Gamma-Ray Images—Radiation Detection Technology;
- Diagnostic Systems;
- Chemical Aspects of Actinide; and
- Martian Carbonates.

The ANCD is building on CMS long-range planning activities to better define a specific plan to promote the development of existing and new scientific capabilities. Among the goals for this plan are developing strategies for: recruiting the best young scientists, developing our scientists and leaders, enhancing programmatic investments in our capabilities, and expanding our research portfolio. A key objective is to manage all of our “tech base” elements to more effectively execute our dual role in program support and scientific development. Creating new capabilities provides programs with resources for long-term program development; currently we plan to develop a new capability in bioanalytical mass spectrometry. Highlights of our recent success for two of our well-established capabilities, radiochemistry and radiation detection, are (1) the development of a gamma water marking technology, which received an IRD&100 Award; and (2) the creation of a new ultraheavy element, element 114, see Figure 7. Among the many challenges for future success is to determine more effective ways for Scientific Capability Leaders to empower others to follow their lead outside of a direct programmatic context. Central to ANCD philosophy is forging strong communication links between Scientific Capability Leaders, Program Element Leaders, and a team approach to identifying future avenues of development.

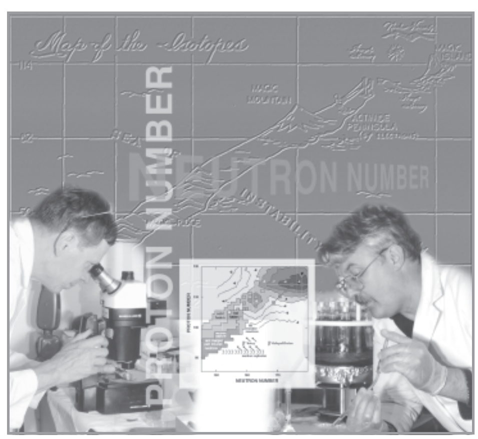


Figure 7. *Element 114.*

Unlike other manufactured heavy elements, element 114 is relatively long-lived, surviving for 30 seconds—as opposed to mere microseconds—before decaying. And some of element 114’s decay particles lived for an unheard-of 16.5 minutes. The significance of element 114’s long life is the support it gives to the theory that the more densely packed the nucleus of heavy elements, the more stable they are. This stability should make it easier for scientists to study the chemical properties of these manufactured elements to see if they match those of more familiar, naturally occurring elements.

Glenn T. Seaborg Institute for Transactinium Science—Louis Terminello, Director

The ANCD also houses the Glenn T. Seaborg Institute for Transactinium Science (GTS–ITS) whose mission is to provide educational and research opportunities in transactinium science at all levels, including undergraduate, graduate, postdoctoral appointees and other sciences, to provide U.S. leadership in the field of transactinium science.

Louis Terminello is the Director of the Institute and Patrick Allen is the Deputy Director. The Institute establishes collaborations in transactinium science between universities, national laboratories, and industry. The GTS–ITS mission supports the long-term manpower and core competence needs of the defense-related and the environmental programs at LLNL. The focus of the GTS–ITS is to educate and train the next generation of scientists with the knowledge and expertise required to meet the nation's changing needs in the following areas: transactinium sciences, nuclear waste isolation, environmental protection and remediation, national security nuclear surveillance, nuclear energy, and industrial application of nuclear methods. The Institute hosted its second Actinide Sciences Summer School Program (ASSSP) this year in partnership with the LLNL Education Office and the DOE/DP. The intent of the ASSSP is to encourage students to pursue scientific careers in general and to give them exposure to the actinide sciences so that they may consider careers in these fields that are at the heart of the DOE mission. The ASSSP is aimed at undergraduate students who have shown an interest in nuclear science. This program builds on the classroom education and offers "hands-on" laboratory research work with actinides. At the end of the summer program, the students give a poster presentation on their research projects and LLNL staff and senior management and university professors are invited to attend. To date there have been 20 students who have participated in the ASSSP over the past two years—19 from the U.S. and 1 from the United Kingdom.

Figure 8 shows Brian Sebastian, one of 12 students who participated this past summer. Brian is a junior undergraduate student in Physics at the University of Washington. He was the recipient of a distinguished achievement award in calculus at Bellevue Community college and is a member of the Phi Theta Kappa national honor society. Brian's summer research project was in the field of X-ray Absorption Spectroscopy (XAS). The primary objective of his research was to help determine the accuracy of computer codes that perform complex theoretical calculations required for XAS data analysis by analyzing XAS data from actinide compounds of known structure. As part of his project, Brian also learned about XAS data collection at the Stanford Synchrotron Radiation Laboratory. Brian's scientific mentor for this project was Patrick Allen. At the end of the ASSSP program, Brian expressed that his research project provided him with practical new skills, but it also gave him a much deeper appreciation for the importance and complexity of modern techniques in synchrotron spectroscopy, and that the ASSSP has succeeded in motivating him for a career in the Actinide Sciences.

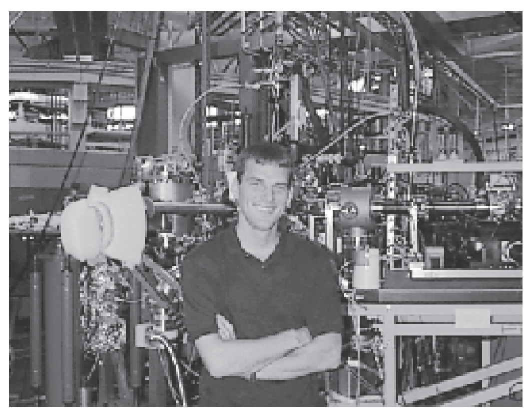


Figure 8. *Brian Sebastian—one of 12 students that attended the 1999 ASSSP.*

Chemistry & Chemical Engineering—Charles Westbrook, Division Leader

The Chemistry & Chemical Engineering Division's (CChED's) primary mission is to support the Laboratory's programs. To accomplish this and to be recognized by the scientific community at large, five scientific disciplines have been identified and are being utilized to foster growth in science and technology. Each discipline has a leader who is responsible for the growth and development of that particular capability, in both the programmatic and technical areas. Key activities for each discipline are summarized as follows:

- Chemical Engineering is a fully-matrixed capability with staff involved in a number of high profile projects, including optics development and 3σ damage for the National Ignition Facility (NIF). One of the growth areas for chemical engineers is in projects related to nonproliferation and counter-intelligence for the NAI Directorate.
- Computational Chemistry is rapidly becoming a central part of the research portfolio in CMS. *Computational chemistry of energetic materials* is investigating a number of areas including detonation or slower burning conditions, kinetics of high-energy density materials, and electronic structure computational modeling for high explosives. *Combustion chemistry* research within CChED deals primarily with ignition, flame propagation, quenching and emissions from internal combustion engines. Reaction mechanisms have been developed for fuels with as many as 8–10 carbon atoms, requiring extensive computational resources. *Chemical warfare agents modeling* is developing reaction mechanisms for systems similar to common CW agents. For example, CW agents molecular and atomic structure can be related to hydrocarbon molecules treated in the past in kinetic models.
- Energetic Materials is a key scientific, as well as a programmatic activity for CChED. Besides the aformentioned computational effort, activities in Energetic Materials include performance and aging testing, materials characterization (chemical, mechanical properties, thermodynamic, and equation-of-state), and synthetic organic chemistry. The Energetic Materials Center is a facility that is a unique cornerstone of CChED.
- Chemical Synthesis and Processing has the sol-gel and aerogel research and technology as its single largest component to the synthesis effort in CChED. However, it also has other capability building projects, including biosensor development, dendritic methodology for the development of new polymer systems and functionalized thiacrown ethers for waste remediation. New areas of investment include bio-related synthesis, organic and polymer materials aging and unique nanomaterials. Figure 9 shows one of CChED's staff scientists synthesizing tailored polymer materials.
- Physical Chemistry has historically built a base of fundamental understanding of materials compatibility and chemistries through chemical optical spectroscopy. Key capabilities include optical spectroscopy, laser-induced chemistry and general photo-chemistry, data processing, molecular dynamics and kinetics.

The growth of these scientific capabilities is directly related to long-range programmatic technical needs, or facilitating the growth of new strategic opportunities. CChED will continue to improve its collaborations with the Laboratory programs, and continue to initiate scientific and technical capabilities for their future needs.

Figure 9. *Staff scientist synthesizing tailored polymer materials.*

Materials Science & Technology—Louis Terminello, Division Leader

The Materials Science and Technology Division (MSTD), is a Division of about 135 scientists (75%) and scientific support (25%) personnel. It is organized into a number of program elements and scientific capabilities—a hybrid of program and discipline focus that reflects the numerous ways it serves the materials science needs of the Laboratory. Program elements are aligned with specific projects in DNT, Energy, the National Ignition Facility (NIF), and Nonproliferation, Arms Control, International Security (NAI) programs. In general, MSTD is focused on metallurgy, ceramics, electrochemical processing, materials science, material characterization, surface science, solid-state chemistry, and materials theory and modeling. Its workforce is comprised of chemists, physicists, metallurgists, ceramicists, chemical engineers, materials scientists, and mechanical, chemical, and electrical technicians. This professional diversity and broad subject matter expertise makes MSTD a valuable component of an evolving Laboratory.

MSTD maintains expertise in the characterization and modeling of the mechanical properties of metals and in the development of relationships between microstructure and properties. This also includes experience with the mechanical properties of inorganic composite materials as well. The Joining element spans the entire range of metallic and non-metallic inorganic materials joining. Joining of exotic, toxic or hazardous materials is a specialty. The Ceramics capability is focused primarily on the fabrication of monolithic parts from ceramic powders using hot pressing, sintering, hot isostatic pressing or plasma spraying techniques. MSTD also maintains a well-equipped metallography laboratory which serves the needs of many programs.

Its Metals Processing capability has the ability to synthesize and process metals in a number of different ways. In metals processing, we can melt and cast experimental alloy compositions using vacuum induction melting and electron beam cold hearth melting; small quantities of material can be alloyed using an electron beam button melting furnace; material can be hot forged and hot and cold rolled; swaging and cold drawing are possible to provide wire and rod sample materials; materials can be shaped by hot forming, deep drawing and spin forming. Vacuum, inert gas and ambient heat treating capabilities are available to further control the physical properties of materials processed by the variety of hot and cold working processes. Room temperature and high temperature testing capabilities are available to characterize the physical properties of the test material.

Both Chemical Vapor Deposition (CVD) and Physical Vapor Deposition (PVD) facilities are available to fabricate shapes or provide surface coatings. These processes can provide shapes in hard to fabricate materials such as tungsten or provide surface coatings useful in providing corrosion, oxidation and wear resistant surfaces. We have a world recognized capability in multilayer fabrication for X-ray optics and other applications. A most recent accomplishment of this program was development of the optics for the TRACE X-ray telescope (see Figure 10).

Figure 10*. Million Degree Solar Corona—multilayers used in the TRACE Telescope provide images.*

The Electrochemistry Capability can provide innovative solutions to a variety of problems, such as innovative battery concepts, waste treatment, refinement and extraction of metal from salts, a wide variety of electrochemical sensors, mercerization of cotton fibers, reduction in the water required to wash fabrics and the use of the bipolar cell for lithium metal recovery from lithium chloride. The development and study of corrosion technology uses MSTD's electrochemistry capability. Proper design of hardware and structures requires the understanding of the corrosion of materials, sometimes on a geological time scale as in the Yucca Mountain Program. Testing facilities are available to help assess and predict corrosion behavior.

A full suite of materials characterization capabilities is available, i.e., scanning electron microscopy, Auger spectroscopy, Rutherford backscattering and associated techniques using our 4 MeV ion accelerator, X-ray diffraction, atomic force microscopy, scanning tunneling microscopy, and various synchrotron based analytical methods. This past year a new, state-of-the-art transmission electron microscope (see Figure 11), was obtained jointly by CMS and DNT. We have fully instrumented, experimental surface science capability to carry out sample preparation, modification, characterization, including in-situ analytical measurements during transient behavior. A precision bonding facility allows detailed investigation of interfaces between a wide range of materials. These capabilities support the dual mission of fundamental research and direct support of laboratory programs.

MSTD has a world-class materials theory and modeling capability to calculate materials structure and properties over many length scales from quantum mechanics (total energies, magnetic, electronic, thermodynamic and transport properties), atomistic simulation applied to defects and diffusion in solids (radiation damage, ion implantation, dopant diffusion), phenomenalogical modeling of processes (metal working operations such as casting, welding, material failure such as crack propagation, fatigue) and other theoretical work. Our material modeling and theory capability is an essential tool for the Laboratory's programs and for our basic and applied research.

Figure 11. *A 300 keV Field Emission Transmission Electron Microscope with full high-resolution imaging and analytical capabilities.*

Program Focus

Stockpike Stewardship Management Program (SSMP)—Jeffrey Kass, CMS Materials Program Leader

CMS supports many of the stockpile stewardship tasks and programs conducted by the Defense and Nuclear Technologies (DNT) Directorate. These tasks and programs enhance U.S. defense capabilities through innovative materials and chemical R&D and the application of new science and technology to issues of concern to the U.S. Defense community. CMS assists all DNT organizations with strategic planning efforts as required, new program initiatives, and scientific reviews.

Program representatives are: Dick Lear, B-Program; Dave Stanfel, A-Program; and Steve Root, W-Program. CMS participants and their program functions are John Kolb (Deputy MPL and A-Program), Jim LeMay (Deputy MPL and compatibility), Gil Gallegos (Pu/U and B-Program), Al Lingenfelter (Pu/U), Bill Wolfer (Modeling), Sid Niemeyer and Ron Lougheed (Radchem), and Jon Maienschein and Randy Simpson (HE).

The goals of the SSMP Materials Program Office are extensive. These goals include but are not limited to:

- Provision of oversight and coordination for all CMS support to Stockpile Stewardship (A, B, and W Programs).
- Provision of the highest quality staffing and technical training for programmatic work.
- Planning and execution of R&D required for programmatic success.
- Assistance in identifying and providing required capital equipment.

Keys in achieving these goals are assurance that lab and experimental activities are cost-effective and high-quality, providing suitable input to allow proper CMS staff administration and facilitation of effective two-way communications of program goals, issues and progress.

CMS provides DNT programs with approximately 100 FTEs of assigned matrix support. The Nuclear Component Materials and Chemistry funding, Tech Base funding and LDRD tasks provide direct program support, reduction to practice and forward-looking research, respectively. The crucial Nuclear Component Materials and Chemistry area will expend roughly $6.3M during the current fiscal year. Due in large part to the growth of the overall funding level, the SSMP office has strengthened the coordination of CMS work internally as well as facilitated better communications. It has moved top people into crucial DNT assignments in HE, compatibility, Pu metallurgy, compatibility, surveillance and radiochemistry.

Five focus areas of intense investigation under the Nuclear Component Materials and Chemistry umbrella that will continue to be investigated in FY00 are:

- Compatibility efforts,
- Direct system support,
- Accelerated aging efforts for Pu,
- Radiochemistry assessments, and
- HE safety/properties/retention of synthesis capability.

FY00 Technology Development projects related to SSMP interests include:

- HE shock physics,
- Pu shock physics, and
- Cross section studies.

Under the auspices of LDRD, the SSMP Office will:

- Investigate aging effects and defect structures in Pu,
- Experimentally validate theoretical interatomic potentials,
- Map enhanced nuclear stability in the heaviest elements,
- Investigate microstructure orientation effects on properties,
- Apply molecular dynamic calculations to HE safety, and
- Apply aerogel technology and synthesize new nanostructure HEs.

***Laser Programs—
Trish Baisden,
Materials Program
Leader***

The CMS Directorate provides Laser Programs with about 40 FTEs of assigned matrix support.

The NIF will produce conditions where nuclear fusion reactions may be studied and materials tested at extreme temperatures and pressures. Chemists, physicists, material scientists, and chemical engineers in CMS work in an integrated fashion to develop and field optical materials for high peak power lasers. Some examples include:

- Continuous melting technology for laser glass;
- Rapid crystal growth technology for KDP (potassium dihydrogen phosphate);
- High-speed, deterministic polishing of fused silica lenses and windows;
- Diffractive optics fabrication for beam uniformity and color separation;
- Fabrication of inertial fusion targets in support of energy research and defense programs;
- Precision cleaning and anti-reflection coatings for optical components.

FY00 Technology Development projects related to Laser Programs' interests include:

- Computational Tools and
- Depth Profiling.

Nonproliferation, Arms Control, International Security (NAI)—César O. Pruneda, Materials Program Leader (Acting)

The NAI Directorate's mission is to support the U.S. government and international agencies in their efforts to reduce the danger from nuclear weapons and other threats from weapons of mass destruction.

The NAI Materials Program Office Objective is to promote the success of NAI programs by facilitating NAI–CMS interactions, providing technical experts, coordinating collaborative research, assisting in program development, and building or enhancing key CMS capabilities.

Materials Program Liaison, César Pruneda, NAI MPO team [and interface] members are: Nathan Wimer and August Droege (Z Division), Pat Grant (Forensic Science Center), Judy Kammeraad (Radiation Detection Center), Wayne Ruhter (PPAC), Chuck Stevens, Dave Camp, and Dave Shoemaker (Q Division), Martyn Adamson and Bill Wilson (R Division).

The total for CMS effort in NAI programs is approximately 40 FTEs of which about 30 are essentially full time in the NAI program elements:

- Forensic Sciences and other R-Division programs,
- Proliferation Prevention and Arms Control, and
- Counterproliferation Analysis and other Q-Division programs.

Current MPO priorities include the following:

- Identify areas for cooperative chemical warfare/biological warfare (CW/BW) program growth; team with key experts in NAI, BBRP, EES and other directorates to pursue selected opportunities.
- Promote joint LDRD projects in NAI-related research.
- Undertake the development of selected capabilities (“technology development”) that aid NAI and other programs.
- Promote strategic investment of Institutional General Purposed Equipment (IGPE) funds to build CMS capabilities that aid NAI and other programs.
- Assist NAI in finding excellent chemical engineers for the CAPS program.
- Help NAI link and promote LLNL radiation detection experts and capabilities to benefit all of the programmatic and discipline stakeholders.
- Continue to aid the Forensic Science Center by providing technical experts, managing the matrix environment effectively, and promoting the enhancement of key technical capabilities.

FY00 Technology Development projects include:

- Chemical Sensors, Bob Glass;
- Biological Mass Spectrometry, Eric Gard;
- BioSecurity Support, Bill Wilson;
- Molecular Recognition Applied to Advanced Field Sensors, Chuck Stevens;
- Chemistry in the Environment, John Reynolds.

Energy and Environment—Jesse Yow, Materials Program Leader

The CMS Energy and Environment Materials Program Office (MPO) supports programs conducted by the Council for Energy and Environmental Systems (CEES), Energy Programs Directorate, Earth and Environmental Sciences Directorate, and Environmental Protection Department at LLNL. These programs enhance U.S. energy and environmental security in three cross-linked and highly multidisciplinary areas:

- Nuclear Materials Stewardship, including:
  —Repository systems for radioactive waste disposition;
  —Nuclear materials processing, stabilization, and separation;
  —Complex engineered materials system performance simulations;
  —Advanced systems for nuclear energy and proliferation resistant fuel cycles;
  —Nuclear systems safety and security.
- Energy Security and Stewardship, including:
  —Carbon utilization, separation, capture, and sequestration;
  —Energy conversion, storage, and use for transportation and utility systems;
  —Fuel system and fuel additive modeling and assessment;
  —Combustion kinetics and modeling;
  —Advanced manufacturing technologies and durable materials.
- Environmental Security and Risk Reduction, including:
  —Environmental monitoring and assessment;
  —Remediation and waste management technologies;
  —Critical energy and environmental infrastructure protection;
  —Water resource characterization and diagnostics;
  —Multiscale (temporal and physical) atmospheric fate and transport.

CMS provides energy and environmental programs with about 40 FTEs of direct and indirect support, with people working in leadership as well as support assignments. About 25 additional staff members support these programs through recharged analytical services. The programs benefit from several CMS LDRD projects that support energy and environmental interests:

- A General Method for Coupling Atomistic to Continuum Mechanics Simulations with Application to Stress Corrosion Cracking (Andrew Quong).
- Chemical Aspects of Actinides in the Geosphere: Towards a Rational Nuclear Materials Management (Patrick Allen).
- Diagnostic Systems Approach to Watershed Management (Lee Davisson).
- Effects of Radiation on the Mechanical Properties and Structural Integrity of Nuclear Materials (Tomas Diaz de la Rubia).
- Colloidal Transport of Actinides in the Vadose Zone (Annie Kersting).

FY2000 Technology Development projects that will support energy and environmental interests are not yet finalized.

Jesse Yow leads the CMS Energy and Environment MPO Team. The Team includes Bryan Bandong, Chris Choate, John Cooper, Wendy Darcey, Thomas Diaz de la Rubia, Dan Decman, Bob Glass, Al Lingenfelter, Cindy Palmer, Dave Smith, Steve Steward, Charles Westbrook, and others as needed. The MPO supports the energy and environmental programs by:

- Providing a direct interface between the energy and environmental programs and CMS.
- Assisting energy and environmental organizations with strategic planning, new initiatives, and scientific review.
- Coordinating scientific and technical staffing for responsive support.
- Facilitating program access to CMS capabilities and facilities.
- Coordinating research and technology development to anticipate and meet program needs.

FY00 program development activities will focus on carbon fuel cycle management, atmospheric fate and transport, depleted uranium, environmental management, and other areas determined by CEES and program investment strategies.

Department of Defense (DoD) Technologies—César O. Pruneda, Materials Program Leader

The objective of this office is to expand the CMS Directorate's portfolio of Department of Defense (DoD) projects and to coordinate non-DoD work-for-other (WFO) activities. The science and technology applied in the DoD and WFO projects serve to enhance and build CMS competencies which support laboratory programs in national security, energy and environment, and bioscience and healthcare. These program development activities are performed and managed solely by CMS or collaboratively with other directorates and LLNL's DoD Programs Office. Another outcome of CMS DoD and WFO activities will be opportunities to develop and enhance the project leadership and management skills of CMS personnel.

The DoD Materials Technologies Leader Team: CMS Division Leaders, Materials Program Leaders, and key program element personnel.

CMS's current DoD and WFO portfolio is varied both in the level of funding of individual projects and range of sponsoring agencies, private and governmental.

Current DoD Technologies Office priorities include expanding programs in:

- Energetic materials synthesis, formulation, manufacturing, performance, vulnerability, reliability, storage, and demilitarization.
- All areas of CW/BW: signatures, detection, analysis, mitigation, and demilitarization; activities in this arena will focus on identifying and engaging appropriate DoD elements collaboratively with CMS NAI MPL and NAI personnel.
- DoD environmental arenas where CMS, Energy, and Environmental directorates (and other directorates) have unique capabilities that can be coupled collaboratively to address pressing national needs in these areas; activities in this arena are performed collaboratively with CMS Energy and Environment MPL (Jesse Yow) and personnel from other directorates.

Other priorities include working with the relevant CMS MPLs in identifying strategic directions and investments that can make an impact on DoD and WFO program development activities.

In FY99, reported costs for federal agencies were $1.7M, DOE laboratories included $1.6M, and non-federal work $1.5M.

In FY00, total WFO budgets are projected to be $5.0M.

Capabilities Focus

Materials Computation, Analysis and Processing (MCAP) Program—Howard Hall, Program Leader

The MCAP mission is to focus on CMS core capabilities to solve key LLNL materials problems. As its primary responsibility, MCAP strategically manages and invests in CMS scientific capabilities to sustain and enhance their value to the Laboratory's mission and programs. MCAP committee members represent the three divisions within CMS, with Howard Hall as Program Leader. MCAP was implemented in FY98 as CMS Strategic New Initiative with Louis J. Terminello as Program Leader.

Major FY99 Accomplishments

- Redesigned IGPE portfolio process to incorporate multi-program interests and input from Materials Program Leaders.
- Managed $1.7M of IGPE investment in CMS capabilities.
- Initiated human capability investments.
- Consolidated Mass Spectroscopy
- Developed and improved capability recharges:
  —Major consolidation of recharge service centers to one Directorate-wide service center.
- Increased MCAP committee membership developing strong capability leadership across the CMS divisions.
- Developed CMS MCAP web pages.
- Implemented IGPE presentation series for requested items over $50K.

FY99 IGPE Investments

- Optical Parametric Oscillator Laser System,
- Accelerated Solvent Extraction Particle Size Analyzer,
- Particle Size Analyzer,
- Intensified Charged Coupled Device Camera and Spectrograph,
- Multipurpose Diffraction System w/ CPS120 position sensitive detector,
- Control/Data Acquisition System,
- Bioscope Atomic Force Microscope Module, and
- Inductively Coupled Plasma Quadrupole Mass Spectrometer.

FY00 Strategic Actions

- Continue improving MCAP business practices,
- Enhance customer satisfaction,
- Continue developing formalized MCAP investment strategies that map onto CMS strategic vision, and
- Begin the IGPE submission request earlier in the fiscal year.

Institutional Focus

Space Action Team (SAT)—Mitch Waterman, Program Leader

The Space Action Team (SAT) is an integrated multidiscipline, multi-directorate, cross-trained team of diverse talents and skills dedicated to safely, economically, and efficiently plan and execute facility projects to support Laboratory missions. The team's functional capabilities comprise Hazardous Waste Management (HWM), Environmental, Safety and Health (ES&H) technicians, and craft support, teamed with professional ES&H disciplines.

SAT's primary objective is to work in partnership with its customers to support facility-related issues and concerns that impact their research activities. SAT uses a cradle-to-grave process to achieve this, working hand-in-hand with its customers to define and execute their projects. The team's staffing configuration is designed to implement moderate to high-risk facility projects. FY98–99 project categories include:

- Decontamination and demolition of perchloric contaminated exhaust systems.
- Decontamination and demolition of nine Laboratory surplused R&D facilities.
- Planning and execution of over 200 programmatic research relocation and/or disposal activities (e.g., wet chemistry labs, physics labs, surplus low-level waste).
- Supporting division-level organizations in their migration—jointly accomplishing the following:
  —colocation of functional groups to enhance collaborative research activities,
  —lowering operating costs and enhanced facility capabilities,
  —coordinating more efficient use of space, and
  —releasing and disposing nonessential surplus contaminated equipment and property.

SAT, based in the CMS Directorate, operates as a recharge center and supports clients throughout the Laboratory. SAT's methodology is outlined in the site-wide Operating Safety Procedures (OSPs) developed specifically for the team's unique operations and missions. SAT's organizational chart is at the end of this section.

Mentoring Focus

CMS Postdoctoral Program—Glenn Fox, Program Leader

The CMS postdoctoral program gives the postdoctoral associates a broad and career enhancing experience, exposing them to a wide variety of research, facilities, and scientific staff. Historically, postdocs have had a difficult time integrating into the Laboratory's unique culture. Therefore, the postdoc program provides a resource for information, needs, and guidance in how to effectively navigate at LLNL. Several new tools have been added during FY99 to enhance the program:

- New Employee Orientation (Quarterly)—This presentation provides an overview of the history of LLNL, the role of its Programs, CMS, safety, security, and other informational resources useful for day-to-day activities. The presentation is also available on the internal CMS website.
- Postdoctoral Symposium—A series of talks and poster sessions given by the postdocs to highlight their research activities and capabilities. The first series was given during the summer.
- Postdoctoral Social Events (Quarterly)—The postdocs, mentors, and management meet during lunch to hear a guest speaker and to discuss concerns and current Laboratory and scientific events.
- Monthly Postdoc Seminars—The Program strongly emphasizes educating the postdoc staff about other programs and science around LLNL. The monthly seminar provides a variety of speakers (all CMS postdocs are required to present at least once during their tenure).
- Greater Exposure to LLNL Facilities—LLNL has research facilities and resources virtually unique to any other laboratory in the country. The postdoc program is facilitating interactions between CMS post-docs and these capabilities, providing points of contact and other needed information.
- Enhance CMS' Research Profile and Portfolio—This year, the postdoc program identified and hired several research associates in identified strategic CMS research areas to include: bio-mass spectroscopy, computational chemistry, and synthesis chemistry. Since postdocs are becoming better integrated into scientific and program projects, several of them will be transitioning to other support in the next year.
- Cross-Directorate Collaborations—The postdoc program is also beginning to collaborate with other directorates to find strategic personnel that can address areas of mutual interest. Also, utilization and interaction with the Lab-wide Lawrence Fellowship Program has located several high-quality postdoctoral appointees for CMS.
- Enhance Contacts External to LLNL—The continued goal is to improve current and future contacts (e.g., academia and other national laboratories). LLNL enhances its credentials and reputation as a world-class laboratory of science when a postdoc's tenure is a postive experience. A CMS postdoc hired in an academic or industrial atmosphere becomes a future source of talent and an unofficial representative of the Directorate.

Directorate Awards

In November 1998, Laboratory Director, Bruce Tarter, authorized a pilot Directorate Awards Program to recognize one-time achievements that have notable impact on the Directorate or organizations and/or contribute to the pursuit of excellence at LLNL.

Programmatic contributions will be recognized by the Program Directorates through their awards program.

Awards categories for CMS are as follows:

- Scientific/Technical,
- ES&H,
- Leadership,
- Operations and Administration, and
- Institutional Impact.

Award Types and Criteria

Directorate Quarterly Awards

Quarterly awards are based on nominations received. Individuals or teams receive cash awards ranging from $75 to $1,000. The criteria includes:

- Significant scientific/technical accomplishment, breakthrough, or discovery.
- Outstanding and/or unusual creativity and/or initiative used in accomplishing work assignments, including problem definition and solution.
- Significant innovation by an individual or a team that contributes to progress towards the completion of a project milestone.
- Exemplary performance to an important organizational need.

Table 7 lists the FY99 recipients.

“Spot” Awards

The award includes memorabilia plus a certificate of recognition, which is distributed by senior managers. The criteria includes:

- Significant improvement of quality, efficiency, safety, and productivity in all categories.
- Administrative or management practices that have organizational effect.
- Outstanding achievements in support of CMS, Directorate goals or values (e.g., for community service, ES&H, cost cutting/ enhanced efficiency, educational outreach, and diversity.

Recipient names are maintained by the Division Offices.

Table 7. *FY99 Directorate Award Recipients.*

Category	Title	Reason	Award Recipient(s)
ES&H	NMR Rescue	Significant outstanding contributions beyond the scope of normal job assignment	Sophia Hayes, Robert Reibold, Joe Satcher
ES&H	The Scientific Safety Team	Extraordinary commitment and effort to enhance ES&H awareness and effectiveness	Troy Barbee, Karen Jautaikis, Dave Smith, Roz Swansiger, Rich Torres
ES&H	Integrated Work Sheet Electronic Form	Achievement of process improvements resulting in greater efficiency and/or cost savings	Sharon Beall, Joe Carlson
ES&H	Institutional D&D Projects	Exceptional creativity in the achievement of a project or assignment -and- Extraordinary commitment and effort to enhance ES&H awareness and effectiveness	Mo Bissani, Gail Everson, Dan Haynes, Bob Henry, Travis Hunt, Pete LaCurtis, Joe Magana, Mike Niemi, Gil Ramirez, Kay Tracy, Sue Vallely, Mitch Waterman, Annmarie Wood-Zika
Institutional Impact	TEM	Significant outstanding contributions beyond the scope of normal job assignment	Michael Fluss, Michael Cooke, Al Moser, Adam Schwartz, Mark Wall, Barbara Pulliam
Leadership	CMS Postdoctoral Program	Exceptional creativity in the achievement of a project or assignment	Bryan Balazs, Ted Baumann, Glenn Fox, Kim Hallock, Robert Maxwell, Tai Nyugen, Chris Orme, Maureen Tortorelli, Lou Terminello, Joe Zaug
Leadership	CMS New Employee Orientation Program	Significant outstanding contributions beyond the scope of normal job assignment	Bryan Balazs, Glenn Fox
Operations & Administration	Training Plan for ASSSP	Exemplary Teamwork	Dabbie Schleich, Scott Dougherty
Operations & Administration	Shipping Plan for 238Pu enriched materials	Extraordinary productivity	Tom Shell
Scientific/ Technical	Element 114 discovery	Significant outstanding contributions beyond the scope of normal job assignment	Ron Lougheed, Ken Moody, Mark Stoyer, Nancy Stoyer, John Wild
Scientific/ Technical	Gamma Watermarking	Significant outstanding contributions beyond the scope of normal job assignment	Ronald Lougheed, Kenton Moody, Winifred Parker, Tzu-Fang Wang
Scientific/ Technical	Pu Transport	Significant outstanding contributions beyond the scope of normal job assignment	Annie B. Kersting, David K. Smith
Scientific/ Technical	Predictive HE Synthesis	Exceptional creativity in the achievement of a project or assignment	Laurence Fried, Philip Pagoria
Scientific/ Technical	Trace Project	Exceptional creativity in the achievement of a project or assignment	Troy Barbee

Strategic Plan

In FY99, CMS continued developing long-range strategies for: recruiting the best young scientists, developing its scientists and leaders, enchancing programmatic investments in its capabilities, and expanding its research portfolio.

In particular, implementation efforts were focused on Science and Technology (S&T) to:

1. Strive for scientific excellence and relevance to Laboratory missions. Goal: Create an integrated and balanced research portfolio.
2. Expand CMS role and influence in external scientific communities. Goal: Increase collaborations and visibility.

S&T Integrated Investment Plan Goals

- Develop process, rationale, criteria, priorities for investment;
- Create a preliminary S&T Integrated Investment Plan for FY00.

S&T Integrated Investment Plan Drivers

- Program—Program needs drive CMS S&T investments, CMS plan is coordinated with the programs' plans (and co-invested);
- Disciplinary—Current and future program and institutional needs define the scientific capabilities CMS must enhance;
- Institutional and External—CMS seeks institutional and external roles to enhance its science.

Staffing and Demographics

As of July 31, 1999, the CMS workforce (by head count) is 475. This workforce is comprised of 71% career, 12% non-career, 7% postdoctoral, 3% retiree, 5% student, and 2% supplemental labor (see Table 8). Table 9 shows staff profile and degree composition for career, non-career and retirees (by head count) is 412. The staffing breakdown is 62% scientists and engineers, 27% technicians, and 11% administrative and clerical.

The breakdown within the scientific and engineering disciplines is 19% physicists, 50% chemists, 18% engineers, and 13% metallurgists. About 75% of the scientists and engineers in CMS have a Ph.D.

The scientific staff by Discipline is shown along with postdoctoral labor in Table 10.

A discipline staff profile spanning ten years is shown in Table 11.

Table 8. *CMS Workforce.*

Workforce Category	Heads	Staff%
Career	**338**	**71%**
Full-Time	328	69%
Part-Time	8	2%
Leave of Absence	2	0%
Non-Career	**58**	**12%**
Term (Full-Time)	21	4%
Term (Part Time)	1	0%
Indeterminate	4	1%
Flex Term	32	7%
Leave of Absence	0	0%
Total Career and Non-Career	**396**	**83%**
Other Labor	**70**	**15%**
Postdoctorals	31	7%
Retirees	16	3%
Students	23	5%
Other Labor non-CMS	**9**	**2%**
Supplemental Labor	9	
Total Other Labor	**79**	**17%**
Total CMS Heads	**475**	**100%**

Dated: July 31, 1999.

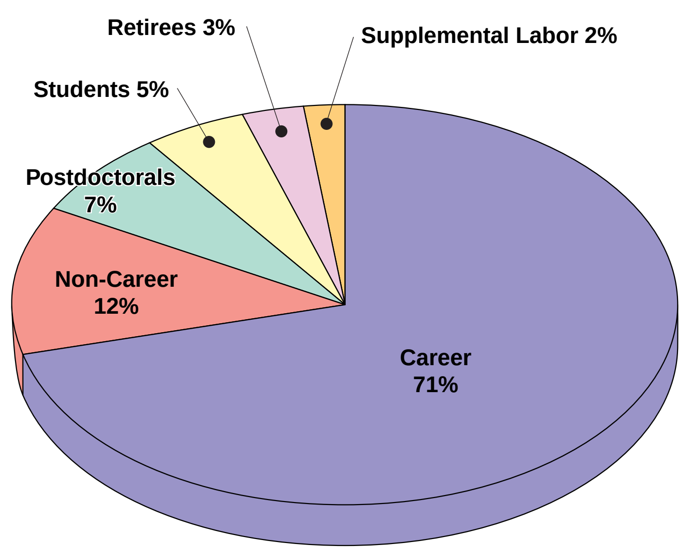


Table 9. *CMS Staff Profile by Job Title and Degree Composition.*

Job Title	PhD	MS	BS	AA	No Degree	Total	Staff %
Scientists & Engineers	**191**	**32**	**32**	**0**	**1**	**256**	**62%**
Physicist —(270)	45	3	0	0	0	48	12%
Chemist—(242)	88	14	26	0	0	129	31%
Engineer/Patent Eng.—(168, 249)	30	10	5	0	0	45	11%
Mathematician/Comp Sci.(256, 285)	0	0	1	0	0	1	0%
Environmental Scientist—(230)	0	1	0	0	0	1	0%
Metallurgist—(265)	28	4	0	0	0	32	8%
Administrative & Clerical	**0**	**5**	**6**	**1**	**31**	**43**	**11%**
Management—(196,197)	0	3	0	0	0	3	1%
Administrative—(100–162)	0	2	4	0	9	15	4%
Clerical/Genl Services—(400–462)	0	0	2	1	22	25	6%
Technical & Crafts	**0**	**6**	**41**	**27**	**39**	**113**	**27%**
Technical—(302–339, 347–391, 502–588)	0	6	41	27	39	113	
Total CMS Heads	**191**	**43**	**79**	**28**	**71**	**412**	**100%**
Degree Composition	**46%**	**11%**	**19%**	**7%**	**17%**	**100%**	

Note: Excludes postdoctorals, summer hires, and supplemental laborers.
Dated: July 31, 1999.

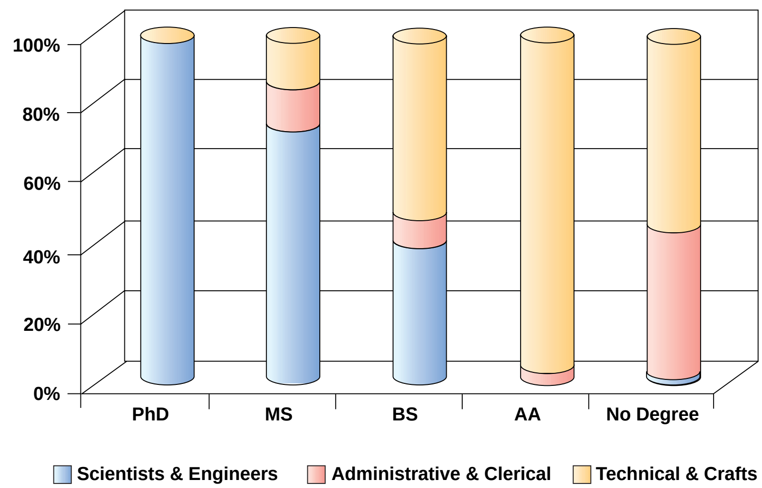
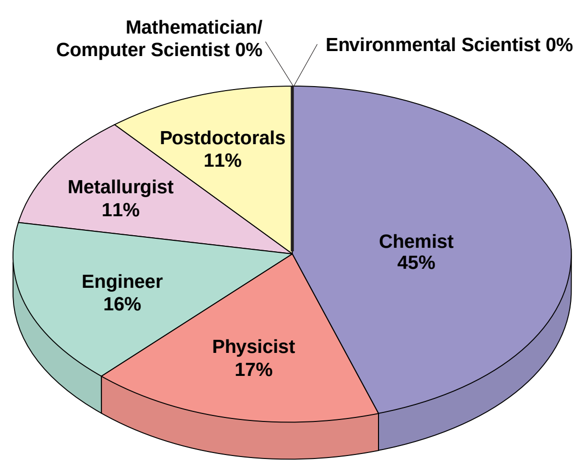


Table 10. *CMS Scientists & Engineers by Discipline and Postdoctorals.*

Job Title	Heads	Staff %
Scientists & Engineers	**256**	**89%**
Physicist—(270)	48	17%
Chemist—(242)	129	45%
Engineer/Patent Eng.—(168, 249)	45	16%
Mathematician/Comp Sci. -(256, 285)	1	0%
Environmental Scientist—(230)	1	0%
Metallurgist—(265)	32	11%
Postdoctorals	**31**	**11%**
Total CMS (Heads)	**287**	**100%**

Includes career, non-career FTEs, and postdoctorals.
Dated: July 31, 1999.



Financial and FTE Highlights

Table 12 illustrates how CMS will be funded in FY00, summarized as follows:

Internal CMS Funding

- Institutional Investment—funding comes from the Laboratory General and Administrative (G&A), Institutional General Purpose Equipment (IGPE), Laboratory Directed Research and Development (LDRD) collections.
- CMS Infrastructure—funding comes from CMS Directorate Program Development Charge (PMC), Organizational Facility Charge (OFC), and Organizational Personnel Charge (OPC) collections.
- Discipline S&T—funding comes from Department of Energy (DOE), federal and non-federal sponsors.
- Program Support—funding comes from CMS Scientific Service Centers collections.

Non-CMS Funding

- Program Support—The Directorate primarily provides discipline personnel for support to all the Programs of the Laboratory. Support for matrixed staff to Program elements is received from other cost centers as FTE allocations.

Table 11. *Ten-Year CMS Staff Profile by Classification.*

Discipline	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Chemist	116	110	85	86	74	125	127	123	128	129
Physicist	22	20	24	22	17	32	31	33	39	48
Metallurgist	32	30	28	30	24	25	22	24	26	32
Engineer	50	48	47	42	38	43	45	46	45	45
Mathematician	0	0	0	0	0	0	0	0	1	1
Environmental Scientist	0	0	0	0	0	0	0	0	1	1
Postdoctoral	13	14	20	25	25	33	29	21	25	31
Technician	111	98	88	87	81	104	107	99	113	113
Admin/Clerical	37	37	40	38	32	39	41	37	39	43
Total CMS (Heads)	**381**	**357**	**332**	**330**	**291**	**401**	**402**	**383**	**417**	**443**

Excludes summer hires and supplemental labor.
Dated: July 31, 1999.

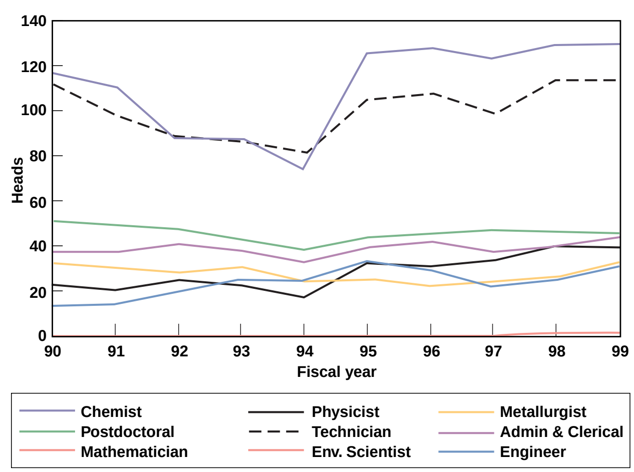


Table 12. *How CMS Is Funded—FY00 ($K).*

Institutional Investment

Institutional	12,967
G&A	7,677
Postdocs/Summers	640
LDRD-ERD	3,000
IGPE-Capital Equipment	1,650

NOTE: Deputy Director S&T manages LDRD Lab-wide

CMS Funding Sources:

Institutional	12,967
Infrastructure	17,026
Research	8,911
Program Support	71,014
TOTAL	109,918

NOTE: CMS managed operating & capital 50,668

CMS Infrastructure

Infrastructure	17,026
Facilities (OFC)	7,215
Info Systems (OFC)	2,067
Personnel (OPC)	6,705
Program (PMC)	1,039

Discipline S&T

Discipline S&T	8,911
BES	3,000
BES-CE	311
Other Direct	600
WFO	5,000

Program Support

Programs	71,014
237 CMS FTEs matrixed (other AD cost centers)	59,250
Scientific Service Centers	11,764

Scientific Service Centers	11,764
Materials Char.	3,525
ASRS	2,890
S300 HE Facility	766
CES	4,000
Nuclear Chemistry	583

Table 13 shows a distribution of CMS FTEs for FY99 and planned FY00. CMS scientific services FTEs are shown matrixed out to illustrate support to programs.

Table 14 shows how CMS managed activities are supported according to funding sources. There are four categories:

- Category 1: Discipline Science and Technology (S&T)—consists of research projects over which the Directorate has jurisdiction. In FY99, this involved 15 FTEs of CMS personnel and 7 FTEs matrixed in from other organizations for a total budget of $9.0M.
- Category 2: CMS Infrastructure—consists of indirect activities involved in operating the Directorate. In FY99, this included 47 FTEs of CMS personnel and 32 FTEs matrixed in from other organizations for a total budget of $15.8M.
- Category 3: Institutional Investment—consists of indirect activities. In FY99, this included 32 FTEs of CMS personnel and 23 FTEs matrixed in from other organizations for a total budget of $15.0M.
- Category 4: Program Support—consists of scientific services (e.g., analytical and processing activities) supporting programs at LLNL. In FY99, this included 50 FTEs of CMS personnel and 16 FTEs matrixed in from other organizations for a total budget of $11.2M.

In FY99, the sum for the CMS managed operating cost center was $49.0M with 223 FTEs (145 CMS and 78 matrixed in). When added to the estimated cost of personnel matrixed (237 FTEs) to support programs, the Directorate's total operating cost was about $107.9M with a capital equipment budget of $2.0M for a total of $109.9M.

In FY00, the CMS managed operating cost center is expected to be $48.7M with 230 FTEs (148 CMS and 82 matrixed in). When added to the estimated cost of personnel matrixed (237 FTEs) to support programs, the Directorate's total operating cost would be about $108.0M with a capital equipment budget of $2.0M for a total of $110.0M.

Figures 12 and 13 show operating and capital costs along with FTEs from FY91 to FY00 (planned).

Table 13. *Distribution of CMS FTEs.*

	FY99	FY00 Plan
CMS Internal Programs	**94**	**95**
Discipline S&T	15	17
Infrastructure	47	49
Institutional Investment	32	29
Program Support & Matrixed Out	**287**	**290**
CMS Scientific Services	50	53
DNT	94	94
Lasers	40	37
Energy	38	38
NAI	37	37
Physics	3	3
Earth & Environmental	5	5
Engineering	4	4
Various	17	20
Total CMS FTEs	**382**	**385**

Note: Minor variances due to rounding.

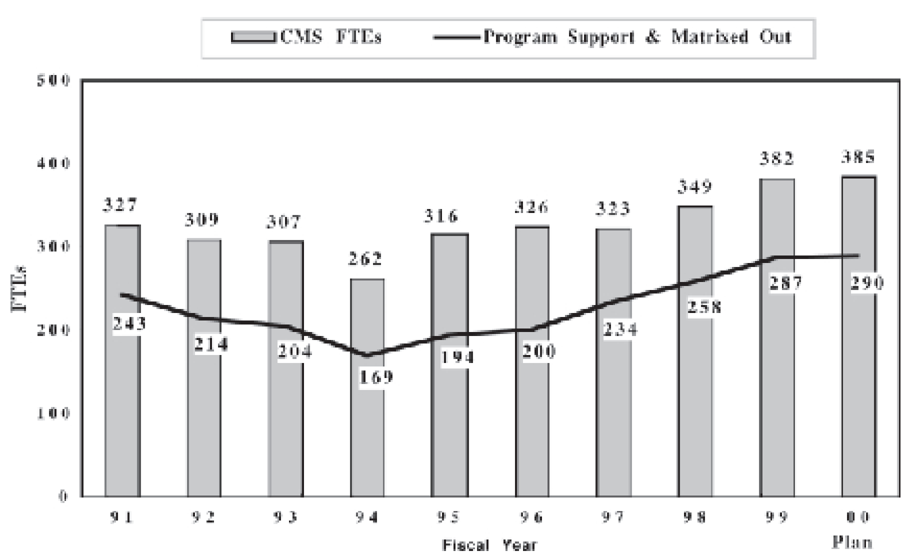


Table 14. *Distribution of Operating and Capital Funds ($M) and FTEs for CMS Cost Centers.*

	FY99 Actual 9/30/99			FY00 Planned 11/5/99		
	$ (M)	**CMS FTEs**	**Other FTEs**	**$ (M)**	**CMS FTEs**	**Other FTEs**
Category 1: Discipline Science & Technology	**9.0**	**15**	**7**	**8.9**	**17**	**6**
DOE-Direct						
Office Basic Energy Sciences (KC02)	3.7	4	2	3.0	4	1
OBES Capital Equipment/Fabrication	0.3	0	0	0.3	0	0
Safeguards and Security	0.1	0	0	0	0	0
Other DOE-Direct	0.2	0	0	0.6	2	0
Work For Others (WFO)						
WFDOE	1.6	6	0	1.7	6	0
Federal Agencies	1.7	2	4	2.2	3	4
Non-Federal	1.5	2	1	1.1	2	1
Category 2: CMS Infrastructure	**15.8**	**47**	**32**	**17.0**	**49**	**40**
Organizational Personnel Charge (OPC)	6.7	36	5	6.7	37	5
Program Management Charge (PMC)	0.9	5	1	1.0	5	1
Organizational Facility Charge (OFC)	8.2	6	27	9.3	7	35
Category 3: Institutional Investment	**15.0**	**32**	**23**	**13.0**	**29**	**19**
General & Administrative (G&A)	8.0	17	16	7.7	17	16
G&A-Special Employee Program (Postdoc/Summers)	0.6	0	0	0.6	0	0
Institutional General Purpose Equipment (IGPE)	1.7	0	0	1.7	0	0
LDRD-Exploratory Research in the Disciplines (ERD)	4.7	16	6	3.0	12	3
Category 4: Program Support	**11.2**	**50**	**16**	**11.8**	**53**	**16**
Scientific Service Centers	11.2	50	16	11.8	53	16
Total CMS Operating & Capital	**51.0**	**145**	**78**	**50.7**	**148**	**82**

Minor variances may be due to rounding.

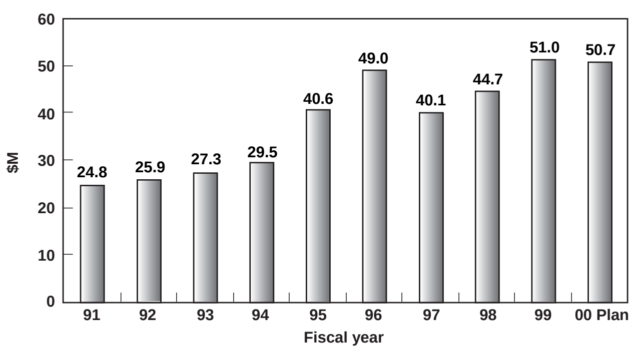


Figure 12. *Ten-Year Distribution of Operating & Capital Funds ($M) for CMS Cost Centers.*

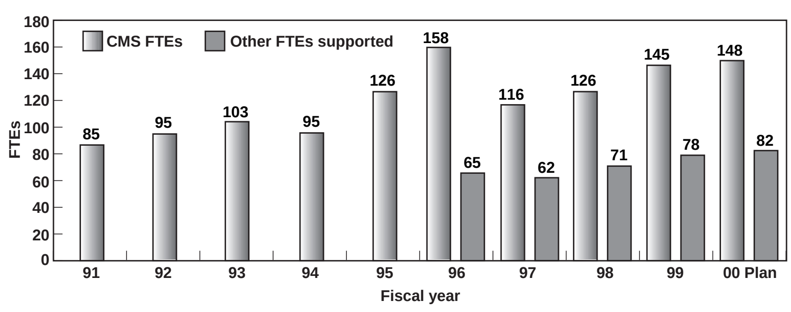


Figure 13. *Ten-Year Distribution of CMS & Other FTEs Supported for CMS Cost Centers.*

Site 200 Facilities

About Site 200

Site 200 is located within the Livermore city limits on one square mile of land. CMS facilities are in the heart of the Laboratory and all facilities are within walking distance (about 5 minutes).

Overview

CMS has several unique chemistry facilities needed to accomplish LLNL programmatic missions. These capabilities include isotope sciences and radiochemistry diagnostics; analytical and characterization services and technology; and material and chemical process theory, modeling, and computations.

Facilities Profile

The Directorate operates 4 facility complexes at the Main Site: B132N, B151, B235, and B241 (see Table 15).

For additional CMS facilities and site development information refer to the LLNL Program Area Plan (PAP) planning document available at http://www.llnl.gov/llnl_only/plant_eng/paps/cms_pap/cmspap.html

OFC Collections

In FY99, OFC collections include $6.9M for CMS owned space (space types include: laboratory, office, cubicle, shop, inside storage, and transportainer/outside storage) and $1.3M for Information Systems (e.g., network and central services) see Table 16. CMS cost centers paid $4.5M or 54%.

Table 16. *CMS Site 200 Space—Who Pays.*

Directorate	FY99 $M	%
CMS		
Institutional Investment	0.64	8%
Infrastructure	0.99	12%
Discipline Science & Technology	0.37	4%
Program Support	2.50	30%
DNT	1.34	16%
Earth & Environmental	0.06	1%
Energy	0.74	9%
Engineering	0.13	2%
Lasers	0.17	2%
NAI	0.79	10%
Various	0.48	6%
Total CMS Space	**8.20**	**100%**

Dated: September 30, 1999.

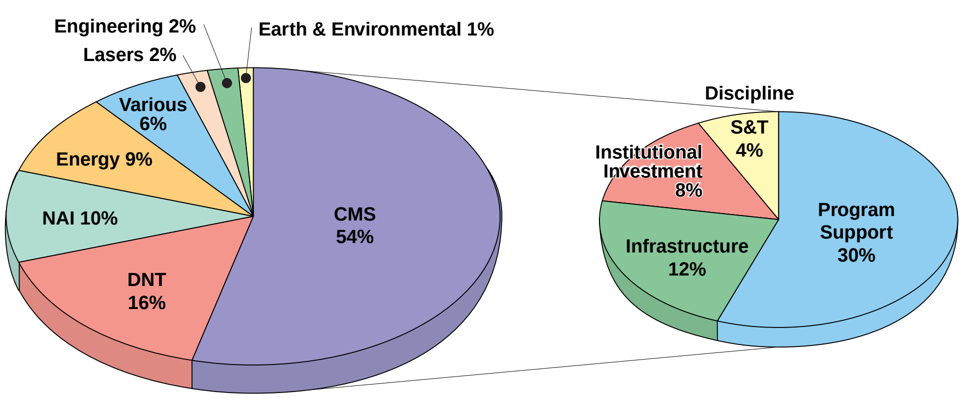


Table 15. *Site 200 Facilities Profile.*

Bldg.	Bldg. Charactistics	Primary Functions	Major Projects	Facility Acquisition Cost
B132N/133: Chemistry Laboratories	• 4 yrs old • 210K gross sq. ft. • Limited Access • Wet Chemistry • 32 Labs • 80 Offices	• Synthesis, Formulation, and Processing Chemistry • Chemical Analysis • Forensics Science	• Installed Chemical Storage Sheds • Upgraded Retention Tanks • Installed LN Tank	• Facility $34M • Equip $12M
B151/154: Analytical & Isotopic Laboratories	• B151 32 years old B154 8 years old • 109K Gross sq. ft. • Limited/Controlled Access • Wet Chemistry • 71 Labs • 111 Offices	• Isotope Sciences and Radiochemistry Diagnostics • Analytical and Characterization Services and Technology • Geochemistry • Stockpile Stewardship • Glenn T. Seaborg Institute for Transactinium Science	• ISF Line Item funding (scheduled for Nov 99) for an office addition and infrastructure upgrades • Completed B154 Heating Ventilation and Air Conditioning Upgrades	• Facility $48M • Equip $15M
B235: Materials Science Laboratories	• 12 years old • 91K Gross sq. ft. • Limited/Controlled Access • Instrument Labs • 30 Labs • 116 Offices	• Materials Development and Technology • Material and Chemical Process Theory, Modeling, and Computation • Materials Characterization Services and Technology	• Completed installation of a state-of-the-art Transmission Electron Microscope (TEM) • Completed partial conversion of building from Limited to Controlled • Relocated X-ray Diffraction, Surface Science, and Coating Laboratories	• Facility $29M • Equip $29M
B241: Materials Technologies Facility	• 39 years old • 63K Gross sq. ft. • Controlled Access • Instrument Labs • 30 Labs • 1 Hi-bay • 40 Offices	• Materials Development and Technology • Materials Disposition • Materials Containment	• ISF Line Item funding (scheduled for Nov 99) for the characterization and spot decontami-nation of B241 (allowing better utilization of B241)	• Facility $21M • Equip $7M

Site 300 Facilities

About Site 300

Site 300 is set on 7,000 acres of land about 15 miles east of Livermore (see Figure 14). It is marked by both rolling hills and steep ravines with very few trees in sight. When it was established in 1955, Site 300 was in a very remote area surrounded only by cattle ranches. It is still remote, but today the growing city of Tracy is expanding toward the site from the east.

Overview

At Site 300, CMS facilities are divided into three groups (see Table 17 Site 300 Facilities Profile):

- Chemistry Area,
- Process Area, and
- Explosives Waste Area.

Chemistry Area

The Chemistry Area is used to formulate and synthesize high-explosive compounds, scaleup laboratory and/or bench scale size high explosives formulations to the production scale, and to perform precision loading of shaped charges using extrusion technology.

Process Area

The Process Area is used to produce precision high-explosives parts and assemblies. The processing area facilities contain the machine tools, isostatic presses, radiography equipment and precision assembly facilities necessary for the manufacture of high-explosive parts.

Explosives Waste Area

As a result of operations at Site 300 and HEAF, energetic material wastes are generated. The explosives waste facilities at Site 300 are comprised of the Explosives Waste Storage Facility (EWSF) and Explosives Waste Treatment Facility (EWTF), both of which are permitted by the California Department of Toxic Substances Control (DTSC) for the storage and treatment of energetic material wastes deemed hazardous by federal and state regulations. EWSF is located in the Process Area and is used to store energetic wastes for up to one year. EWTF is located at Building 845 in a remote area and is used for the open burning and detonation of these energetic material wastes. EWTF also operates under an air permit from the San Joaquin Unified Air Quality Control District.

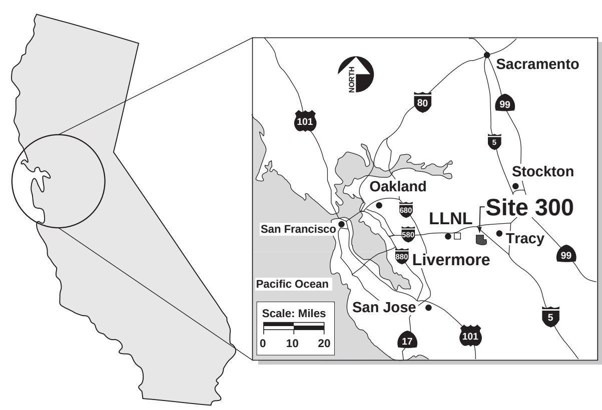


Figure 14. *LLNL Site 300.*

Table 17. *Site 300 Facilities Profile.*

Facility	Facility Characteristics	Primary Functions	Capability
Chemistry Area [1]	• Average 40 years old • 7 Machine Bays • 1 Inspection Bay • 4 Assembly Bays • 2 Radiography Bays • 2 Pressing Bays—Isostatic • 2 Surface Impoundments	• Synthesis • Formulation • Mechanical Pressing • Scaleup	• Custom manufacturing of explosives, some transferred to industry for commercialization (e.g.,simulants, special operations, shaped charges)
Process Area [1]	• Average 20 years old • 8 Formulations/Synthesis/ Injection/Molding • 2 Mechanical Pressing Bays	• Hot Isostatic Press • Radiography • Machining • Inspection • Assembly	• Precision custom manufacturing of HE components and devices for R&D testing
Explosives Waste		• Storage • Treatment	• Storage—1 year • Treatment—open burn/open detonation capabilities

[1] Chemistry and Process Areas comprises 22 major facilities; 15 storage magazines, 8 service magazines, totaling 58,500 square feet, total equipment replacement cost $30M.

Research Administration and Funding

Research is considered an integral part of the Directorate's discipline development. Oversight and policy-making are vested in the AD's office. Currently, the Principal Deputy AD assumes general responsibility for administering the research effort with guidance from the AD and Consultation with Division Leaders and Program Leaders. Programs and projects are reviewed internally as well as externally.

Funding for research and development that is managed in the Directorate comes primarily from Laboratory Directed Research and Development (LDRD), DOE Office of Basic Energy Services (DOE/OBES), and Reimbursable/WFO.

Laboratory Directed Research and Development (LDRD)

The DOE has issued an Order to provide for an LDRD Program that will allow the use of up to 4% of the Laboratory's budget for discretionary research. The LDRD Program at LLNL is divided into three major funding categories:

1. Strategic Initiatives;
2. Exploratory Research in the Disciplines (ERD), Programs, and Institutes; and
3. Laboratory-wide Competition.

The primary focus of LDRD Exploratory Research in CMS is the support of the longer range research objectives of the Laboratory's Programs and the contribution of new science and capabilities that influence their direction and development. Two objectives describe these explicitly:

1. Fundamental research that provides a basic scientific understanding of a specific issue faced by a program, and acknowledged by the program as being important.
2. Development of new science and capabilities focused on chemistry that will seed enduring, externally funded, fundamental science in areas of current or future importance to the Laboratory.

CMS' selection process focuses on projects meeting these strategic objectives but also considers several other important points.

- Projects must be based on the execution of excellent science.
- Whenever possible, projects should provide an opportunity for our more experienced scientists to work with our younger staff, and especially postdocs, in a mentoring relationship.
- Partnering/collaboration with other directorates is encouraged in all areas, and required for program-related research.

In the realm of Strategic Initiatives, the Directorate usually participates as a key member of a team on a Program-sponsored initiative rather than directly leading one, although exceptions to this do occur.

The Exploratory Research in the Programs is funded by R&D collections returned to the directorates that generate the funds. Such funds are designated to provide the technical base for developing both existing and future programs for the Laboratory. CMS frequently plays a role in these projects, through personnel supporting the execution of the science and occasionally by providing the leader for the project.

In general, support for a project is limited to, at most, three consecutive years in this Program. Table 18 shows FY00 CMS ERD projects. Also included are four projects funded from Lab-wide Competition (managed by the Laboratory's S&T Deputy Director).

Table 18. *CMS FY00 LDRD Projects and Budgets.*

CMS Contact	Project Title	Budget ($K)
Lab-Wide Competitive		
Satcher	A New Ultrase	$158
Hayes	Development and Application of High Sensitivity	165
Yan	Nonlinear Optical Tissue Diagnosis	162
Huser	Surface-Enhanced Raman Spectroscopy	165
	Total Lab-Wide	**$650**
ERD		
Fluss	Microstructure Evolution	200
Gygi	Coupled Solvation Model	50
Fox	Chemistry & Processing of Nanostructured Mater	240
Westbrook	Computational Chemistry of Plasma	85
Darrow	Single Molecule Detection	100
Zaug	Kinetics of Elementary Reactions	220
DDLRubia	Effects of Radiation on Mechanical	150
Wilson	Nanolaminates	300
De Yoreo	Carbon Nanotube AFM	130
Schwartz	Grain Boundary Engineering	100
Genin	Laser Deposition of thin Film	125
Suratwala	Slow Crack Growth Behavior	100
Van Buuren	Smart Membranes	170
Landry	Biological Mass Spectrometer	100
Hamza	Surface Nanostructures Formed by Intense Electronic Excitation	50
Quong	A General Method for Coupling	150
Moody	Mapping of Enhanced Nuclear Stability	220
Kersting	Colloidal Transport of Actinides	145
Davisson	Diagnostic Systems	75
Shields	Biological Mass Spectrometry	80
Hutcheon	Martian Carbonates	140
Allen	Chemical Aspects of Actinides	120
	Total ERD	**$3,050**

DOE Direct

The Directorate coordinates funds obtained from the Office of Basic Energy Sciences, Division of Materials Sciences (OBES/DMS), which totaled $3.7M for FY99 (see Table 19). In addition to execution of the majority of the program, this includes reporting, oversight and review for the entire program. The Livermore OBES/DMS Program has three major components:

- Metallurgy and Ceramics Program—addresses a diverse range of topics including adhesion and bonding at internal interfaces, fundamental characterization and modeling of welding processes, as well as research focused on the fundamentals of superplastic deformation.
- Solid-State Physics Program—has three components addressing new concepts in modeling radiation damage in solids, the development and characterization of new optical materials including new lasing materials, and the development of positron science as a key materials characterization technique.
- Materials Chemistry Program—addresses the science of thin buried layers and the exploration of innovative new techniques for characterizing magnetic properties at the atomic level.

Scientific and Technical Achievements

Table 20 lists the Directorate scientific and technical achievements for the 1998 calendar year .

Table 20. *Scientific and Technical Achievements (Jan–Dec 98).*

Metric	Jan–Dec 98 Appraisals
Major Awards	11
R&D 100 Awards	0
Patent Disclosures	10
Patent Applications	22
Patents Issued	9
Licenses Executed	0
Refereed Publications	180
Invited Presentations (major conferences)	77
Journal Editorships[1]	8
Conferences Organized	20
Editorial Boards	8

[1]International Materials Review, Journal of Physical Chemistry, Metal Physics & Advanced Technology , Metallurgical & Materials Transactions, Nanostructured Materials, Proceedings of the MRS Symposium, Proceedings of the TMS Symposium, Welding Journal.

Table 19. *CMS FY99 OBES Projects and Budgets.*

CMS Contact	Project Title	Budget ($K)	Capital ($K)
Materials Science			
Newkirk	Materials Science Research Capital Equipment	—	303
Newkirk	Center of Excellence Synthesis Processing	139	—
Howell	Positron Research	294	—
King	Adhesion & Bonding at Internal Interfaces	265	—
Nieh	Interfaces & Interphases on Superplasticity	612	—
Elmer	Kinetics of Phase Transformation	480	—
Diaz de la Rubia	Radiation Damage	328	—
Payne	Optical Materials	240	—
Howell	Positron Contract	266	—
Tobin	Investigation of Nanoscale Magnetics	461	—
Terminello/ Mailhiot	Growth & Formation of Advanced Heterointerfaces	446	—
Quong	Physical Properties	127	—
Total CMS OBES		**$ 3,658**	**$ 303**

Analytical & Nuclear Chemistry Division

Division Leader
Judy Kammeraad

Deputy Division Leader, Operations
Howard Hall

Deputy Division Leader, Science & Technology
Bob Lanier (acting)

Barbara Royval, Division Administrator
Bollinger, B. — DL Secretary
McGurn, B. — DDL Secretary
Browning, R.
Edinger, L.
Hallock, K.
Maxwell, J.
McFadden, Y.
Montero, D.
Nancy Henry, Resource Manager

Energy & Environment

Environmental Management/ CES
Chris Choate
Dep: Bryan Bandong
Rebecca Browning - Secretary

Bajao
Bandong
Bartholdi
Brockney-Abbott
Choate
Cox
Dixon
Edwards
Ernst
Fontanilla .5
Guthrie
Johnson
Letendre
Magana
Mitchell-Hall
Montero .6
Shen
Stanford
Stimmel
Swanson — 19.1

Civilian Nuclear Materials Stewardship
Steve Steward, CChED
Rebecca Browning - Secretary

Beiriger, King, K, Lippis, Palmer*, Prussin, Roberts, Romanovski*, Torretto, Wruck, Zhao* — 10

Highly Enriched Uranium
Dan Decman
Rebecca Browning - Secretary

Decman, Friensehner, Harris, Leich, Raschke, Ruth — 6

Isotopic Tracers & Transport
Dave Smith
Rebecca Browning - Secretary

Culham, Eaton, Ekwurzel #, Esser, Hudson, Kenneally, Kent ‡, Kersting, Laue #, Moran, Rose, Smith, Volpe, Williams — 14

DNT

Stockpile Radchem
Ron Lougheed
Dep: Ken Moody
Yvonne McFadden - Secretary
Joanne Maxwell .5 CAS/Vault

Henry, G., Henry, N., Lougheed, Moody, Namboodiri, Parker, Stoyer, M., Stoyer, N., Velsko, Wild, Wimer — 11

Pu Technology
Bill Gourdin, MSTD

Pu Analytical
Patrick Epperson
Linda Edinger - Secretary

Epperson, Goins, Mew, Pugh, Sharp, Summers — 6

Compatibility & Aging
Bill McLean, CChED
Dep: Bryan Balazs
Linda Edinger - Secretary

Chambers, King, H. — 2

Energetic Materials
Jon Maienschein, CChED

Weber — 1

NAI

Forensic Science Center
Patrick Grant
Linda Edinger - Secretary

Alcaraz, Bazan, Haas, Grant, Klunder, Nunes, Whipple — 7

Proliferation Prevention & Arms Control
Wayne Ruhter
Rebecca Browning - Secretary

Archer, Beckedahl, Clark, Dougan, Hayden, Lanier (McGurn), Luke, Manatt, Ruhter, Russ, Schmid, Wang

Yvonne McFadden - Secretary

Dardenne, Kreek, Ryon — 15

LASERS

NIF: Optical Mtls
Jeff Atherton, AD Staff
Ruth Hawley-Fedder
Linda Edinger - Secretary

Carman, Ehrmann, Hawley-Fedder, Miller, E., Steele — 5

SCIENTIFIC MEASUREMENT APPLICATION

Phil Miller
Linda Edinger - Secretary

Briant, Chukwueke, Coburn, Duewer, Ertel, Finnie, Gard, Gaylord, Gregg, Haendler, Hampton, Harvey, Hayes #, Hutcheon, Koester, Lane, Lindsey, Maxwell, R., Meissner, Menapace, Miller, P., Phinney, Shields #, Silberman, Torres, Zaka, Zeller — 27

GTS-ITS

Lou Terminello, MSTD
Director
Dep: Patrick Allen

Maureen Tortorelli, Institute Administrator

Secretaries -
Kim Hallock
Joanne Maxwell .5

Allen, Brachmann ‡, Hakem #, Hoffman, Sylwester ‡ — 5

SCIENTIFIC CAPABILITIES

RADIATION DETECTION & SPECTROSCOPY
Steve Kreek

RADIOCHEMISTRY
Ken Moody

INORGANIC ANALYTICAL CHEMISTRY
Joe Menapace

NUCLEAR PROPERTIES OF ACTINIDES
Gene Henry

ISOTOPE GEOCHEMISTRY
Dave Smith

INORGANIC MASS SPECTROMETRY
Ian Hutcheon

BIOANALYTICAL MASS SPECTROMETRY
TBD

ORGANIC ANALYTICAL CHEMISTRY
Hugh Gregg

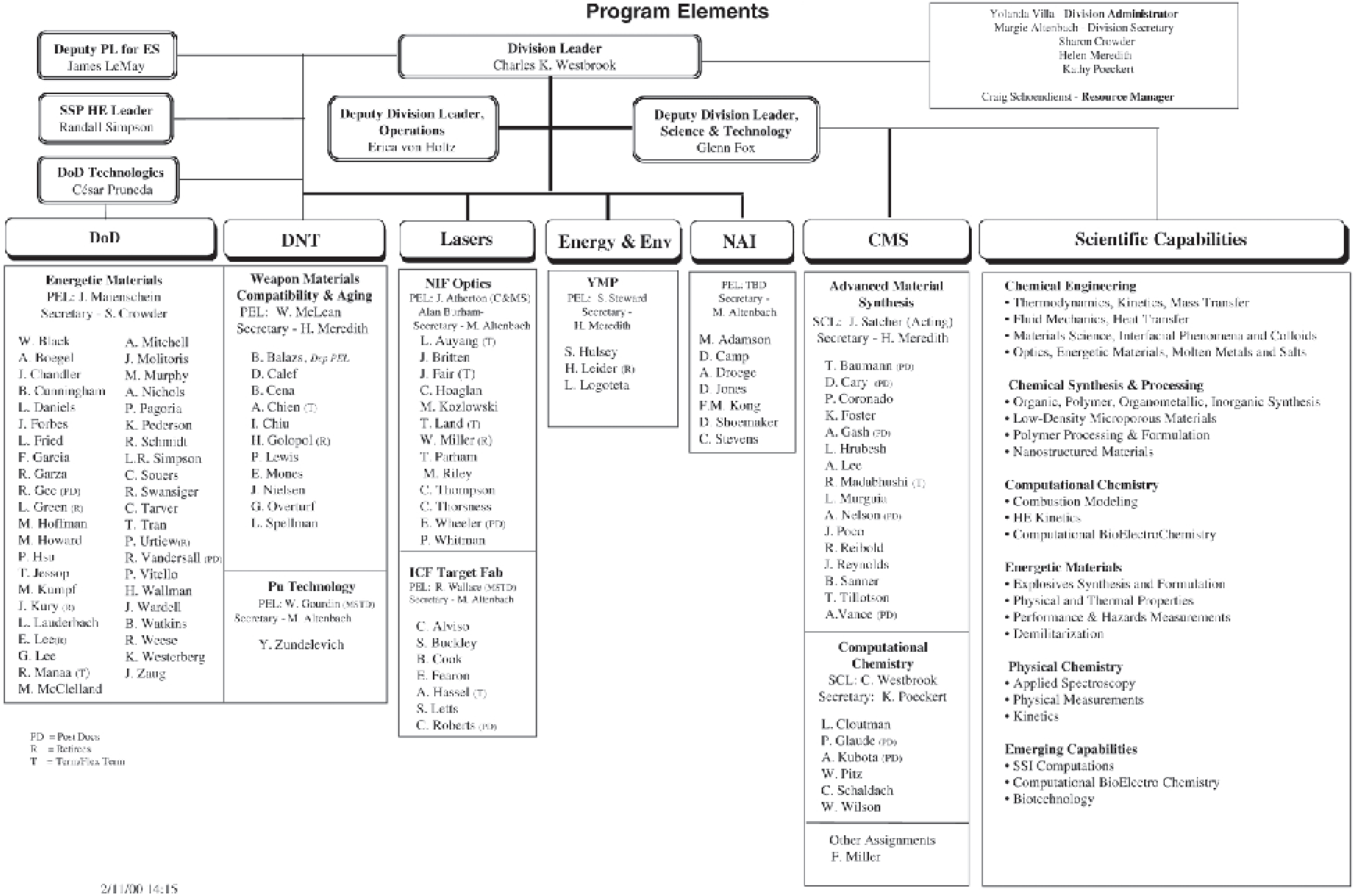
* = GTS-ITS
Italics = Directorate Deputy PEL
‡ = Post Doc
# = CMS Post Doc
1/28/00

Analytical & Nuclear Chemistry Division
Scientific Capabilities

RAD DET/SPEC	RADIOCHEMISTRY	INORGANIC ANALYSIS	NUCLEAR PROPERTIES	ISOTOPE GEOCHEMISTRY	INORGANIC MASS SPECTROMETRY	ORGANIC ANALYSIS	BIOANALYTICAL MASS SPECTROMETRY
Steve Kreek	**Ken Moody**	**Joe Menapace**	**Gene Henry**	**Dave Smith**	**Ian Hutcheon**	**Hugh Gregg**	**To Be Determined**
Archer	Brachmann	Bartholdi	Allen	Ekwurzel	Beiriger	Acaraz	Gard
Bandong	Cox	Bazan	Dardenne	Esser	Culham	Bazan	Shields
Beckedahl	Dixon	Bajao	Hall	Kenneally	Duewer	Chambers	
Clark	Dougan	Brockney-Abbott	Henry, G.	Kent	Eaton	Choate	
Decman	Fontanilla	Briant	Lanier	Kersting	Hudson	Coburn	
Friensehner	Gaylord	Carman	Nash	Niemeyer	Hutcheon	Ehrmann	
Harris, L.	Grant	Chukwueke	Schmid	Rose	Miller, P.	Ertel	
Kreek	Guthrie	Edwards	Stoyer, M.	Smith	Moran	Gregg	
Luke	Hakem	Epperson	Wimer	Volpe	Leich	Haas	
Manatt	Hayden	Ernst			Phinney	Harvey	
Parker	Henry, N.	Finnie			Pugh	Hawley-Fedder	
Raschke	Lippis	Goins			Russ	Hayes, S.	
Ruhter	Lougheed	Haendler			Velsko	King, H.	
Ruth	Moody	King, K.			Zaka	Koester	
Ryon	Namboodiri	Klunder				Lindsey	
Wang	Palmer	Lane				Maxwell	
	Prussin	Letendre				Meissner	
	Roberts	Magana				Mew	
	Romanovski	Miller, E.				Mitchell-Hall	
	Shen	Silberman				Nunes	
	Stanford	Sharp				Ross	
	Stimmel	Steele				Whipple	
	Stoyer, N.	Swanson				Zeller	
	Summers	Torres					
	Sylwester	Weber					
	Toretto	Wruck					
	Wild						
	Williams						
	Zhao						

9/21/99

Chemistry & Chemical Engineering Division Program Elements



Chemistry & Chemical Engineering Division
Scientific Capabilities

Chemical Synthesis & Processing
SCL: J. Satcher (Acting)

Aerogels

P. Coronado
L. Hrubesh
J. Poco
R. Riebold
J. Satcher
T. Tillotson

Polymers

M. Hoffman*
E. Jessop*
S. Letts
R. Madabhushi
C. Roberts (PD)

Synthesis

C. Alviso
T. Baumann (PD)
S. Buckley
D. Cary (PD)
A. Gash (PD)
A. Lee
G. Lee*
A. Mitchell*
P. Pagoria*
J. Reynolds
B. Sanner
R. Schmidt*
A. Vance (PD)

Chemical Engineering
SCL: D. Camp (Acting)

L. Auyang
J. Britten
R. Cena
B. Cunningham*
J. Fair
K. Foster
C. Hoaglan
C. Hsu (PD)
P. Hsu
D. Jones
F.M. Kong
M. Kozlowski
J. Maienschein*
M. McClelland
W. Miller (R)
T. Parham
D. Shoemaker
C. Thompson
C. Thorsness
T. Tran*
E. von Holtz
H. Wallman*
B. Watkins*
K. Westerberg
E. Wheeler (PD)
P. Whitman
Y. Zundelevich

Physical Chemistry
SCL: TBD

Applied Spectroscopy

A. Droege
T. Land
A. Nelson (PD)
C. Stevens
J. Zaug*

Materials Compatibility

B. Balazs
A. Chien
I. Chiu
H. Golopol (R)
J. LeMay
P. Lewis
E. Mones
J. Nielsen
G. Overturf*
L. Spellman

General Physical Chemistry

J. Forbes*
R. Garza*
E. Fearson
A. Hassel
S. Hulsey
H. Leider
L. Logoteta
F. Miller
L. Murguia
R. Swansiger*
S. Steward

Computational Chemistry
SCL: C. Westbrook

D. Calef
L. Cloutman
R. Cook
H. Curran
L. Fried*
P. Glaude (PD)
M. Howard*
A. Kubota (PD)
R. Manaa*
N. Marinov
M. Murphy*
A. Nichols*
W. Pitz
C. Souers*
C. Tarver*
P. Vitello*
W. Wilson
J. Young (PD)

Energetic Materials*
SCL: J. Maienschein

W. Black
J. Chandler
B. Cunningham
L. Daniels
J. Forbes
L. Fried
F. Garcia
R. Garza
R. Gee (PD)
L. Green (R)
M. Hoffman
M. Howard
T. Jessop
M. Kumpf
J. Kury (R)
L. Lauderbach
E. Lee (R)
G. Lee
R. Manaa
A. Mitchell
J. Molitoris
M. Murphy
A. Nichols
G. Overturf
P. Pagoria
K. Pederson
R. Schmidt
L.R. Simpson
C. Souers
R. Swansiger
C. Tarver
T. Tran
P. Urtiew (R)
P. Vitello
H. Wallman
J. Wardell
B. Watkins
R. Weese
J. Zaug

*Some people in EMT have been double counted

rev. 9/13/99

Materials Science & Technology Division

Dick Christensen, Senior Scientist
Bill Wolfer, Program Leader for Computational Materials Science
Michael Cooke, Division Resource Manager

Lou Terminello, Division Leader
Ken Marsh, Deputy Div. Leader, Operations
Tomás Diaz de la Rubia, Acting DDL/S &T

Carol Power, Division Administrator

Administrative Staff
Gonzales, Kathy- Div. Secretary

Copp, Kathy
Jones, Linda
Manipis, Melina
Daugherty, Carol
Lyons, Sherry
Poggio, Nan

DNT

Pu Technology
Bill Gourdin - PEL
Sherry Lyons - Secretary
Mike Blau
Rich Burns
Bob Gomez
Leonard Gray
Terry Quick
Adam Schwartz
Tom Shell
Tien Shen
Paul Curtis
Karen Dodson
Bart Ebbinghaus
Oscar Krikorian (FR)
James Lawson
Doug McAvoy
Harlan Olson
Joe Schmitz
Mel Taie
Rich Van Konynenberg

Stockpile Metallurgy and Joining
Gil Gallegos - PEL
Melina Manipis - Secretary
Ralph Condit (FR)
Ron Foreman
Jim Hanafee
Dave Lassila
Vicki Mason-Reed
Barry Olsen
Paul Sandoval
Ed Sedillo
Leonard Summers
Sharon Torres
John Elmer
Mark Gauthier
Terry Ramos
Larry Wagner

Energy & Environment

Civilian Nuclear Materials Stewardship
Allen Lingenfelter -PEL
Nan Poggio - Secretary
Peter Bedrossian
Laura DeLoach
John Estill
Joe Farmer
Greg Gdowski
Steve Gordon
Bill Halsey
Tiangan Lian*
Bev Lum
Dan McCright
Tammy Summers
Francis Wang

Advanced Energy Technology
Bob Glass - PEL
Carol Daugherty - Secretary
Brandon Chung
Joseph DiCarlo
Jeff Haslam
Quoc Pham

Environment
John Cooper - PEL
Melina Manipis - Secretary
Nerine Cherepy*
Bob Hopper
Roger Krueger
Martin Stratman

Lasers

NIF Optical Materials
Jeff Atherton - PEL
Sherry Lyons - Secretary
Leslie Summers
Tayyab Suratwala

ICF targets
Russ Wallace PEL
Craig Alford

NAI

Forensic Science Center
Pat Grant - PEL
Melina Manipis - Secretary
Rick Randich

Materials Characterization

Materials Characterization Centers
Tom Felter - SCL
Kathy Copp - Secretary
Ann Bliss
Dominic Del Giudice
Cheryl Evans
Jim Ferreira
Dennis Fleming
Bob Kershaw
Karen McDougall
Cheng Saw
Bob Vallier
Mark Wall
Boyd Westfall
Jim Yoshiyama

Solid State Chemistry
Jim DeYoreo - SCL
(S. Lyons)
Thomas Huser* (K. Copp)
Denise Krol (K. Copp)
Mary McBride* (K. Copp)
Aleksandr Noy* (K. Copp)
Christine Orme (K. Copp)
Ming Yan (S. Lyons)

Surface Science
Alex Hamza - SCL
Kathy Copp - Secretary
Dario Arena*
Mehdi Balooch
C. Bostedt(K. Gonzales)
Long Dinh
Michael Hochstrasser*
Ron Musket
Thomas Schenkel*
Wigbert Siekhaus
Jim Tobin
Tony Van Buuren
Joe Wong

Computational Mat'ls. Science

Tomas Diaz de la Rubia - SCL
Linda Jones - Secretary
Eduardo Alonso
Vasily Bulatov
Maria Caturla
Scott Centoni
Tony Gonis (C. Daugherty)
Thomas Lenosky*
Andrew Quong
Moono Rhee*
Babak Sadigh*
James Stolken
Surh, Michael
Patrice Turchi (C. Daugherty)
Lisa Wickham*
Brian Wirth

* -postdoc
#-SLO
FR-Fixed Term Retiree
PEL - Program Element Leader
SCL - Scientific Capability Ldr

Metallurgy and Ceramics

Metallurgy
Francois Genin
(S. Lyons)
Luke Hsiung (S. Lyons)
T.G. Nieh (K. Gonzales)

Ceramics
Keith Wilfinger - SCL
Sherry Lyons - Secretary
Corey Cate
Bill Choi*
Joe Silveira

Coatings, Multilayers & Interfaces

Coatings
Alan Jankowski - SCL
Melina Manipis - Secretary
Kerry Bettencourt
John Chesser#
Norm Thomas

Multilayers
Troy Barbee - SCL
Nan Poggio - Secretary
Jennifer Alameda
Don Hoffman
Paul Mirkarimi

Interfaces
Wayne King - SCL
Carol Daugherty - Secretary
Geoff Campbell
Mukul Kumar
Lan Nguyen
Juergen Plitzko*
Stu Weinland

1/26/00

Materials Science & Technology Division Capabilities

Electrochemistry and Corrosion

Nerine Cherepy*
Brandon Chung
John Cooper
Joseph DiCarlo
John Estill
Joe Farmer
Dennis Fleming
Greg Gdowski
Bob Glass
Steve Gordon
Bill Halsey
Roger Krueger
Tiangan Lian*
Bev Lum
Dan McCright
Quoc Pham
Martin Stratman
Leslie Summers
Rich Van Konynenberg
Francis Wang

Materials Characterization

Materials Characterization Centers
Tom Felter - SCL
Ann Bliss
Dominic Del Giudice
Cheryl Evans
Jim Ferreira
Bob Kershaw
Karen McDougall
Cheng Saw
Mark Wall
Boyd Westfall

Solid State Chemistry
Jim DeYoreo - SCL
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Denise Krol
Mary McBride*
Aleksandr Noy*
Christine Orme*
Ming Yan
Jim Yoshiyama

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Alex Hamza - SCL
Dario Arena*
Mehdi Balooch
Peter Bedrossian
Christoph Bostedt
Long Dinh
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Ron Musket
Thomas Schenkel*
Wigbert Siekhaus
Jim Tobin
Tony Van Buuren
Joe Wong

Computational Materials Science

Tomas Diaz de la Rubia -SCL
Eduardo Alonso
Vasily Bulatov
Maria Caturla
Scott Centoni
Tony Gonis
Thomas Lenosky*
Andrew Quong
Moono Rhee*
Babak Sadigh*
James Stolken
Michael Surh
Patrice Turchi
Lisa Wickham*
Brian Wirth

Metallurgy and Ceramics

Metallurgy
Michael Blau
Rich Burns
Ralph Condit
Karen Dodson
Bart Ebbinghaus
John Elmer
Gil Gallegos
Mark Gauthier
Francois Genin
Bob Gomez
Bill Gourdin
Leonard Gray
Jim Hanafee
Dave Lassila
James Lawson
Luke Hsiung
Al Lingenfelter
Vicki Mason-Reed
Doug McAvoy
T.G. Nieh
Barry Olsen
Harlan Olson
Terry Quick
Terry Ramos
Rick Randich
Paul Sandoval
Joe Schmitz
Adam Schwartz
Ed Sedillo
Tien Shen
Lenny Summers
Tammy Summers
Mel Taie
Sharon Torres
Bob Vallier
Larry Wagner

Ceramics
Keith Wilfinger - SCL
Corey Cate
Bill Choi*
Paul Curtis
Jeff Haslam
Bob Hopper
Oscar Krikorian
Tom Shell
Joe Silveira
Tayyab Suratwala

Coatings, Multilayers & Interfaces

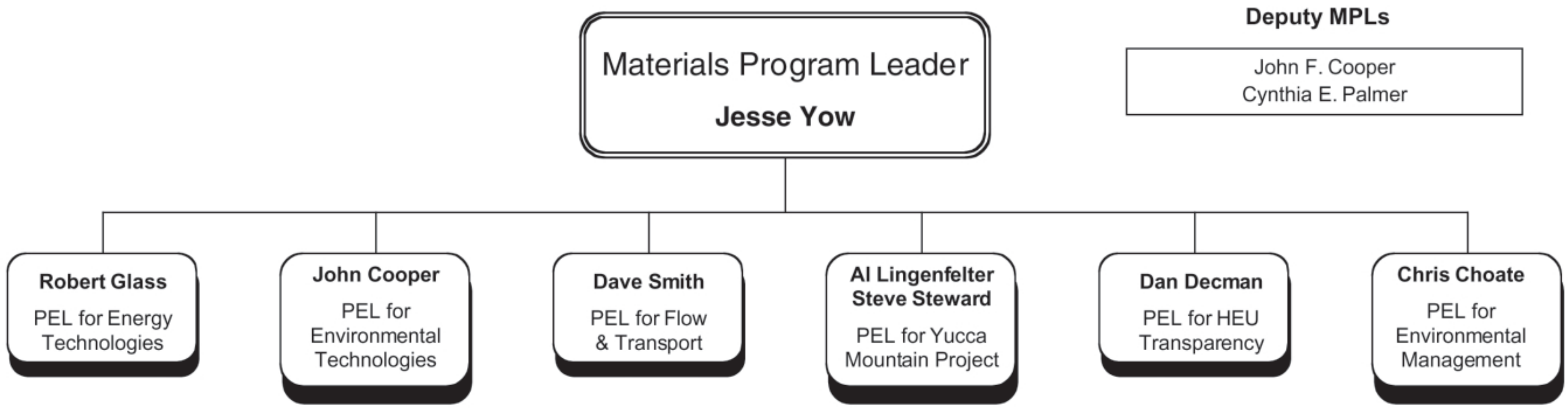
Coatings
Alan Jankowski - SCL
Craig Alford
Kerry Bettencourt
John Chesser#
Ron Foreman
Norm Thomas
Russ Wallace

Multilayers
Troy Barbee - SCL
Jennifer Alameda
Don Hoffman
Paul Mirkarimi

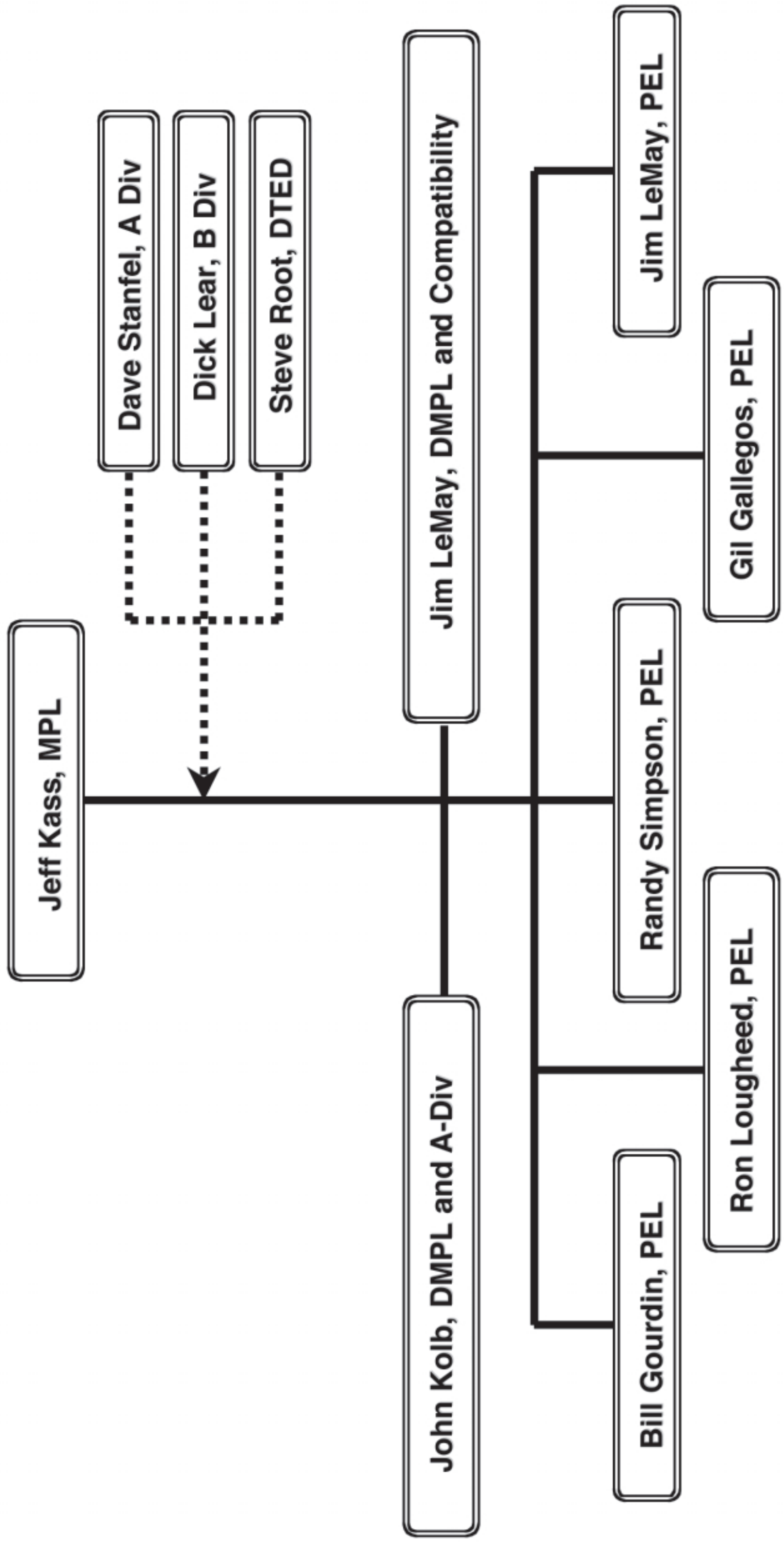
Interfaces
Wayne King - SCL
Geoff Campbell
Mukul Kumar
Lan Nguyen
Juergen Plitzko*
Stu Weinland

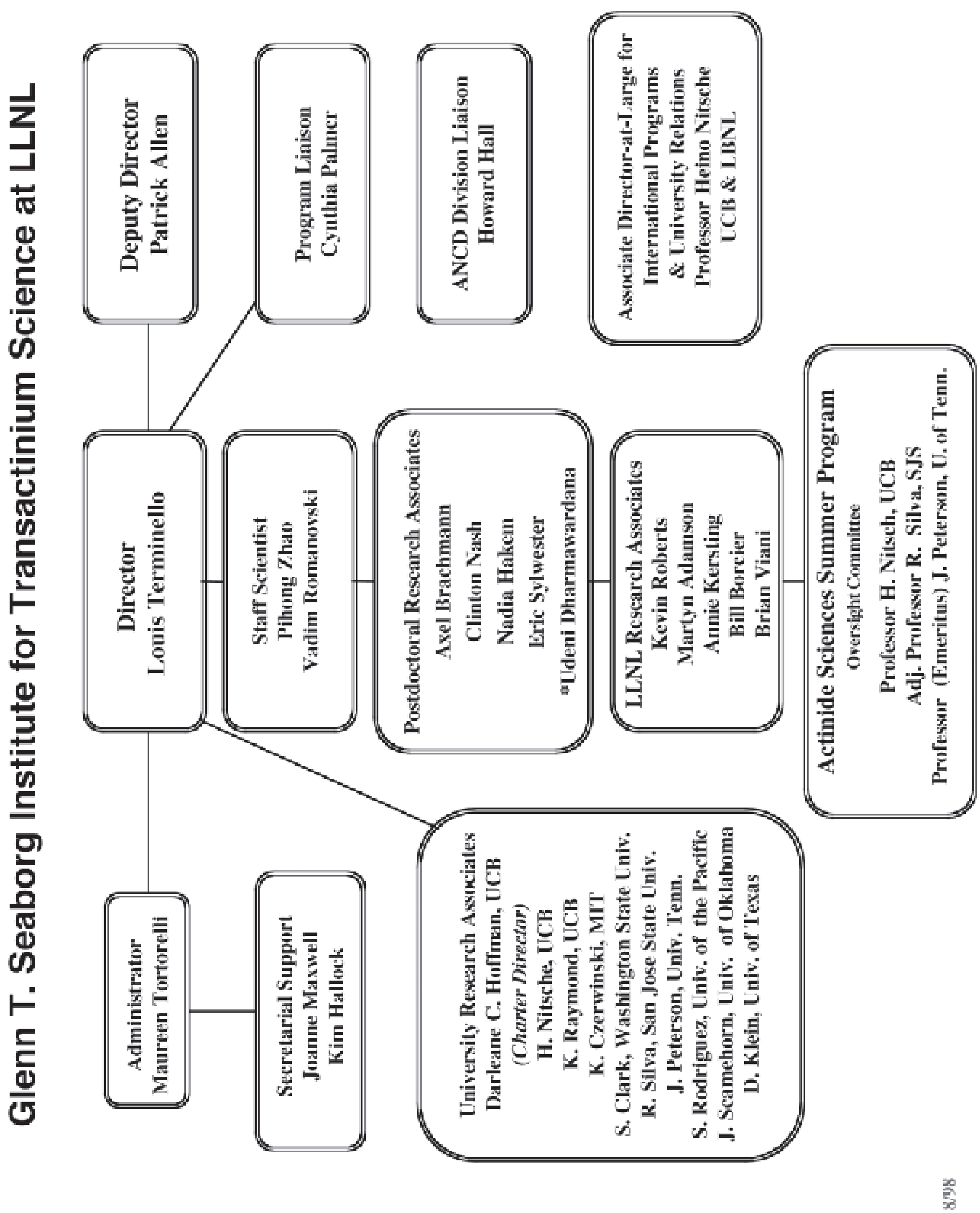
* -postdoc
() - new hires or anticipated hires
PEL - Program Element Leader
SCL - Scientific Capability Ldr.
+ Part. Guest
#SLO

Energy and Environment Materials Program Office

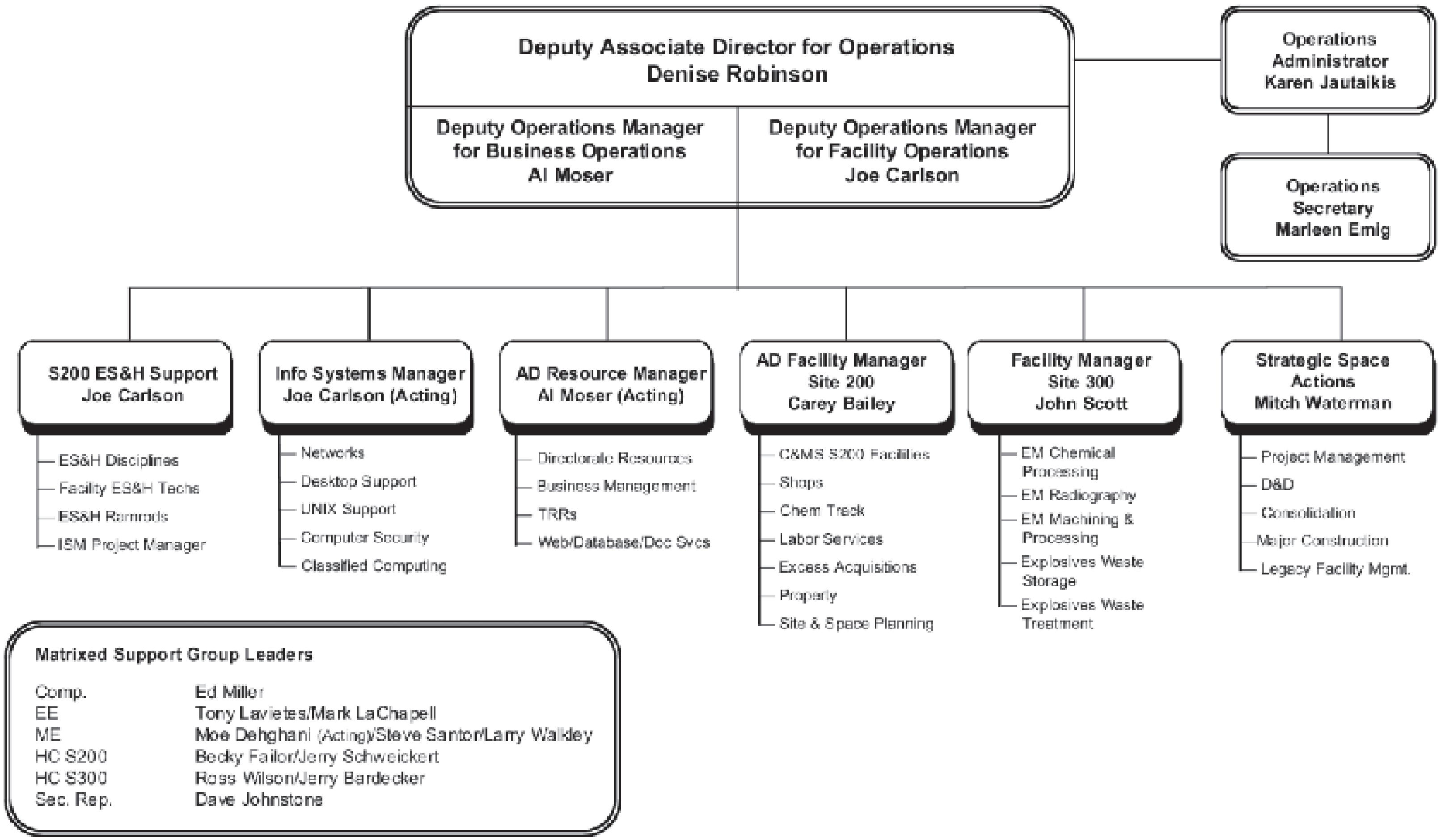


SSMP MPL Structure

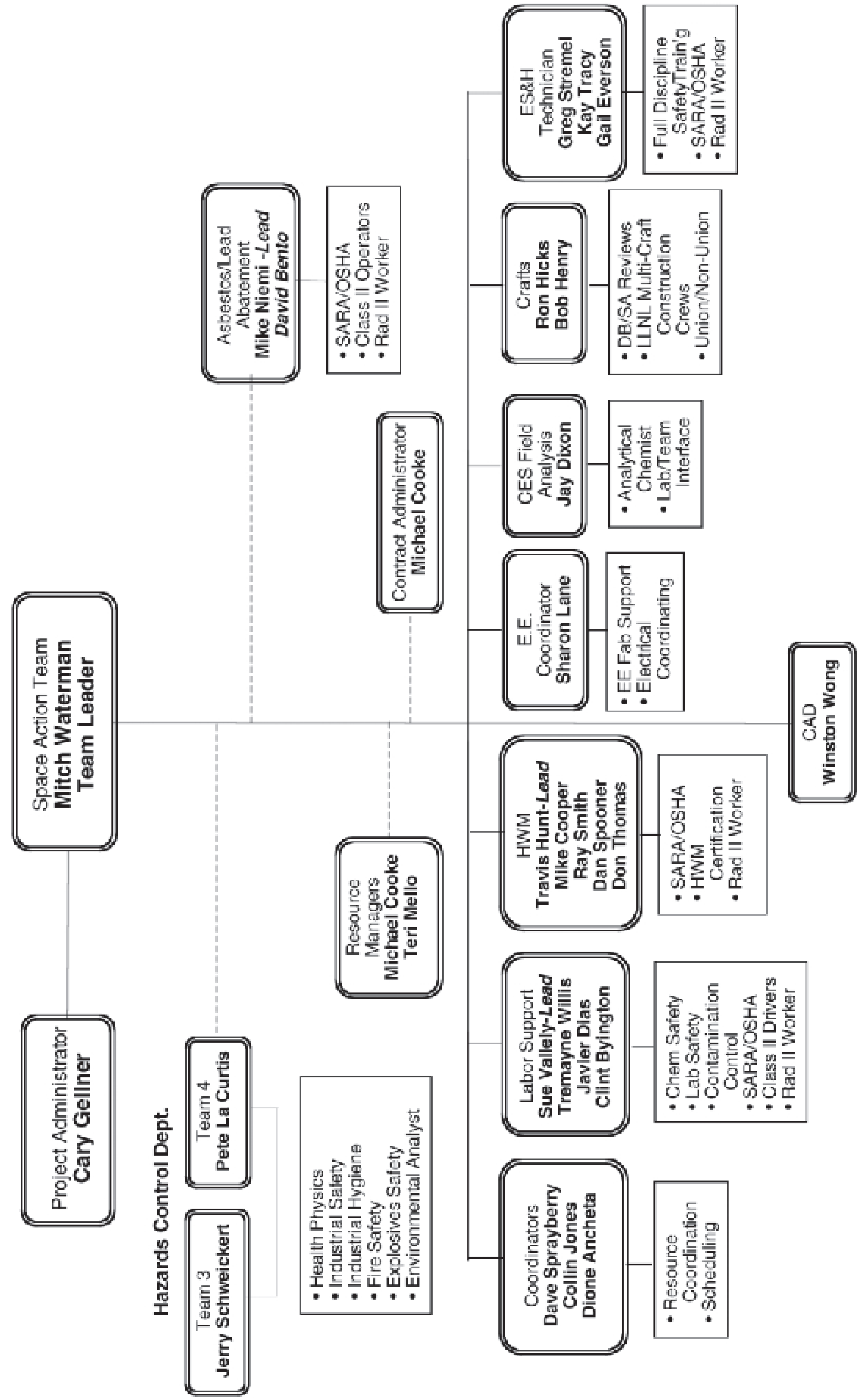



Glenn T. Seaborg Institute for Transactinium Science at LLNL
Director
Louis Terminello
Deputy Director
Patrick Allen
Program Liaison
Cynthia Palmer
ANCD Division Liaison
Howard Hall
Associate Director-at-Large for
International Programs
& University Relations
Professor Heino Nitsche
UCB & LBNL
Administrator
Maureen Tortorelli
Secretarial Support
Joanne Maxwell
Kim Hallock
Staff Scientist
Pihong Zhao
Vadim Romanovski
Postdoctoral Research Associates
Axel Brachmann
Clinton Nash
Nadia Hakem
Eric Sylwester
*Udeni Dharmawardana
LLNL Research Associates
Kevin Roberts
Martyn Adamson
Annie Kersting
Bill Bourcier
Brian Viani
Actinide Sciences Summer Program
Oversight Committee
Professor H. Nitsch, UCB
Adj. Professor R. Silva, SJS
Professor (Emeritus) J. Peterson, U. of Tenn.
University Research Associates
Darleane C. Hoffman, UCB
(Charter Director)
H. Nitsche, UCB
K. Raymond, UCB
K. Czerwinski, MIT
S. Clark, Washington State Univ.
R. Silva, San Jose State Univ.
J. Peterson, Univ. Tenn.
S. Rodriguez, Univ. of the Pacific
J. Scamehorn, Univ. of Oklahoma
D. Klein, Univ. of Texas
8/98

CMS Operations



Space Action Team (SAT)



Acronyms

AEC	Atomic Energy Commission
AD	Associate Director
ANCD	Analytical and Nuclear Chemistry Division
ASSSP	Actinide Sciences Summer School Program
BBRP	Biology and Biotechnology Research Program
CAPS	Counterproliferation Analysis and Planning System
CMS	Chemistry and Materials Science
CChED	Chemistry and Chemical Engineering Division
CE	Capital equipment
CES	Chemistry–Environmental Services
Comp	Computations
CW/BW	Chemical Warfare/Biological Warfare
D&D	Decontamination and Demolition
DL	Division Leader
DNT	Defense and Nuclear Technologies
DoD	Department of Defense
DOE	Department of Energy
DOE/DP	Department of Energy/ Defense Program
DP	Defense Programs
DTSC	Department of Toxic Substances Control
E^3	Energy and Environment
EE	Electronic Engineering
ERD	Exploratory Research in the Disciplines
ES&H	Environmental Safety and Health/Quality Assurance
EWSF	LLNL Explosive Waste Storage Facilities
EWTF	LLNL Explosive Waste Treatment Facilities
FSP	Facility Safety Procedure
FTEs	Full Time Equivalents
FY	Fiscal Year
G&A	General and Administrative
GPP	General Plant Project
GTS–ITS	Glenn T. Seaborg–Institute for Transactinium Science
HC	Hazards Control
HE	High Explosives
HEAF	High Explosives Application Facility
ICF	Inertial Confinement Fusion
IGPE	Institutional General Purpose Equipment
IS	Information System Support Team
ISF	Isotope Sciences Facility
ISMS	Integrated Safety Management System
ITS	(Glenn T. Seaborg) Institute for Transactinium Science
LDRD	Laboratory Directed Research and Development Program
LLNL	Lawrence Livermore National Laboratory
MAP	Materials Analytical Programs
MCAP	Materials Computational, Analysis, and Processing
ME	Mechanical Engineering
MPL	Materials Program Leader
MPO	Material s Program Office
MSTD	Materials Science and Technology Division
NAI	Non-Proliferation, Arms Control, and International Security
NIF	National Ignition Facility
OBES	Office of Basic Energy Sciences
OFC	Organizational Facility Charge
OPC	Organizational Personnel Charge
PMC	Program Management Charge
PPAC	Proliferation Prevention & Arms Control Program
PrHA	Process Hazards Analysis
Pu	Plutonium
PWP	Project Work Plan
RRP	Room Responsible Person
RTI	Returned to Institution
S200	Site 200 (Livermore Main Site)
S300	Site 300 (Livermore Explosives Testing Site)
S&Es	Scientists and Engineers
S&S	Safeguards and Security
SAT	CMS Strategic Action Team
SSMP	Stockpile Stewardship Management Program
SST	Scientific Safety Team
TRACE	Transition Region and Coronal Explorer
UC	University of California
UCB	University of California, Berkeley
WFDOE	Work for Department of Energy
WFO	Work for Others